OCTOBER 1957

GAS

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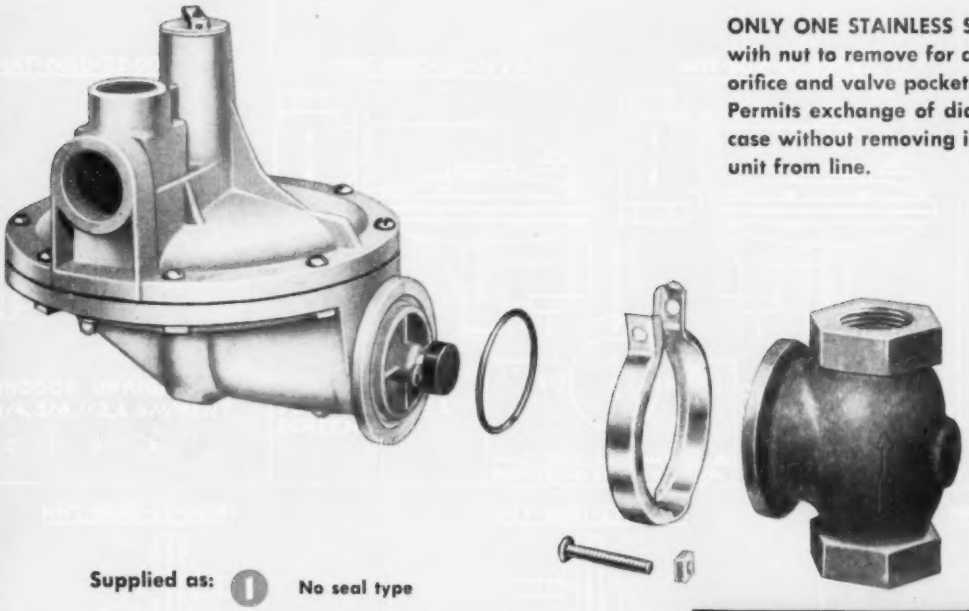

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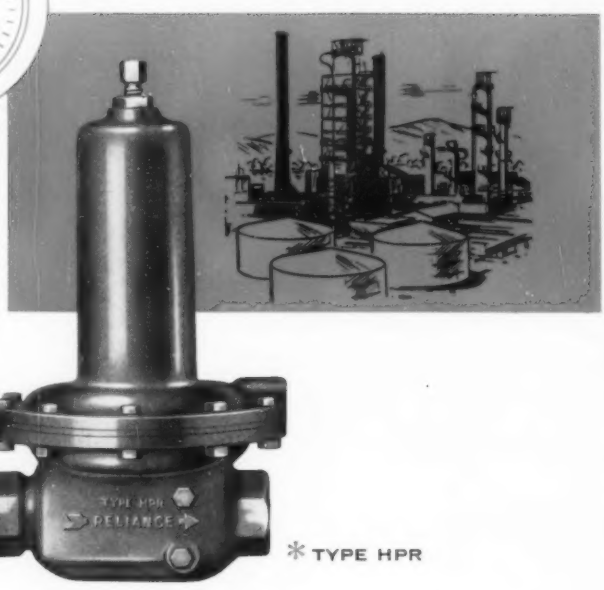

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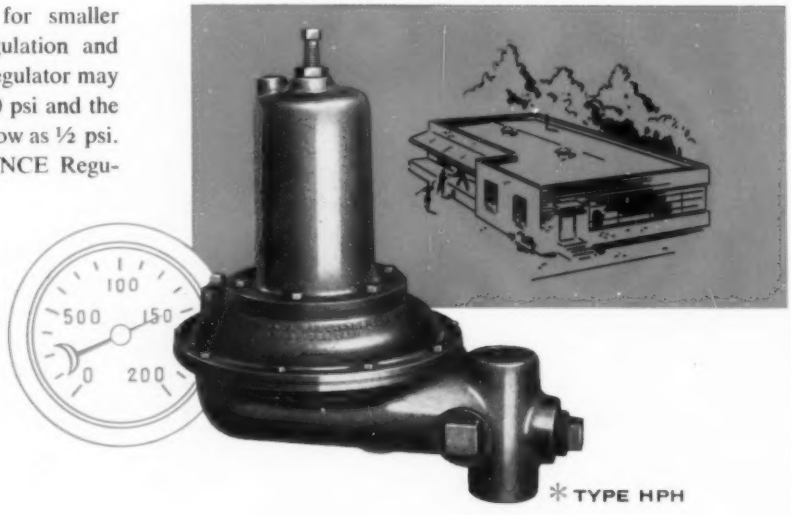

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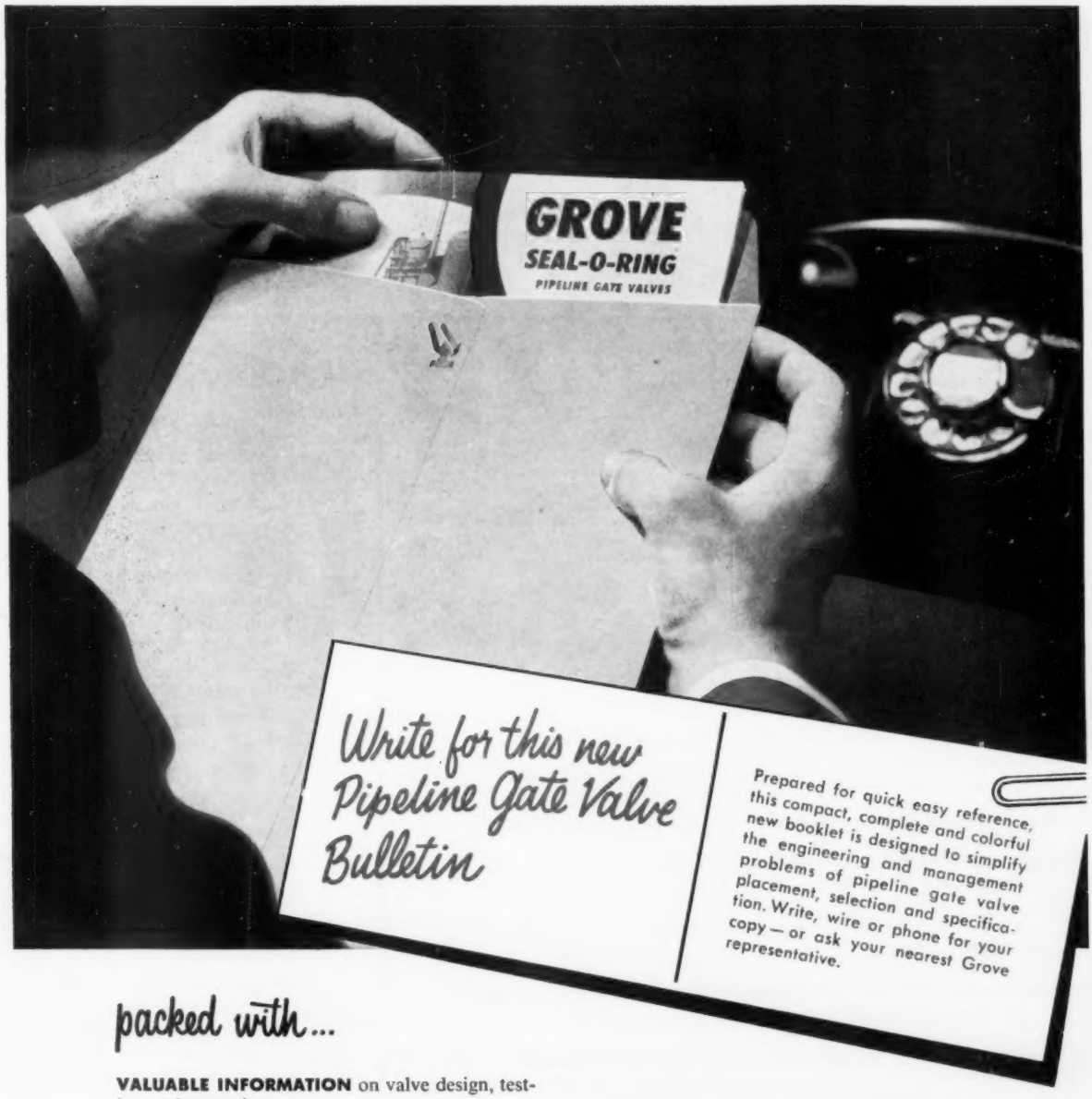

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GAS Thermally Thinking

TROPICAL forests of South and Central America are the habitat of both the two-toed and three-toed sloths. These animals are noted for their disinclination to action. That is a kind way of saying they are just plain slow.

I do not have a toe count on the Federal Power Commission, but hearings before this astute body are slow. Some FPC hearings progress at a pace that makes the sloths (both species) look like the mammals are equipped with four-barreled carburetors and high-speed rear ends. And, from my observation, the more important the case, the longer the hearing.

Current commissioners are not to blame. In fact, on more than one occasion recently specific Examiners have administered verbal wrist pats and warned counselors about jurisprudential dawdling.

Something must be done to accelerate FPC hearings. The way it is now a gas company comes before the commission with a matter of business requiring certification and is met with scores of intervenors, some of whom have less business in the hearing than a representative of the Boy Scouts. A way must be found to weed out this questionable intervention. The FPC is in Washington to protect the public interest, not to give ear to every group with an axe to grind and give gas company and gas-company retained lawyers a place to hear themselves expound.

My legal training consists of reading Earle Stanley Gardner's mysteries. But it doesn't take a legal genius to clearly see that much of the direct testimony, cross examination, and general interchange of verbiage is irrelevant and immaterial (thank you Mr. Gardner). It simply doesn't make sense to have the gas industry's business that must be brought before the FPC under the Natural Gas Act of 1938 hampered and delayed by near-limitless intervenors, tons of paper, and millions of words—many very useless words at that. It is expensive and frustrating to both the FPC and the gas companies. The sad part of it is that counsels for and from the gas companies are heavy contributors to the legal fog generation that slows down some hearings.

Our industry is now complex. Build 200 miles of pipeline in one corner of the nation and it "directly" affects a distribution company in the opposite niche. I would not abridge anyone's rights, but I submit that FPC procedure must be changed to meet the complexities of the times in relation to the gas industry. Streamline the hearings to meet the demands from a dynamic industrial period. It can be done and should be done right now. The gas industry can help itself a lot in this respect.

Finally, the commission should take definite action on the way hearings are conducted in the future and the participation in them. Hearings should be inclined toward action!

J. Fred Ebdon

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The fact that one man can readily carry many 30-ft. lengths of Kralastic pipe, and that the pipe can be quickly "solvent-welded" with a paint brush, has made it popular for transmitting natural gas to operate irrigation pumps in the Southwest. More than 2,900 miles have been used in this way.

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GAS highlights

OCTOBER 1957

SPOT NEWS, TRENDS, COMMENT ON GAS INDUSTRY AFFAIRS

Construction will start on the Coastal Transmission-Houston Texas Gas & Oil Corp. line from Texas to Florida this fall. Houston will start taking delivery of 31,272 tons of mainline pipe soon—enough 24-in. pipe to build 150 miles of line. The pipe will come from Republic Steel's Gadsden, Ala., plant. Houston already has received its first shipment of 16-in. pipe for highway and railroad crossings on the Jacksonville (Fla.) lateral. Coastal, too, is now at work—an 8-in. feeder line in Texas is finished. Houston President F. E. Stanley says the big project should be completed by next September.

A House of Representatives subcommittee has issued a 90-page report charging that Federal agencies are wasting vast sums of money by using natural gas (and oil), instead of coal, at Federal installations. The charge would be laughable except that the subcommittee included a recommendation that a 12-yr commission be set up by the Federal government—with a first-year appropriation of $2 million—to conduct research into new and expanded uses of coal.

Consumers Power Co. will add 20,000 new space heating customers to its gas mains under recent approval by the Michigan PSC. More than half of the new permits will be earmarked for southeastern Michigan.

American consumers will purchase about 300 million gas appliances during the next 17 years, according to GAMA. But they will not be easy to sell. It will take a real selling effort backed by sharp promotion and intelligent advertising. GAMA's Harold Massey (at PCGA) said: " . . . although gas appliances are fully automatic, appliance sales never will be."

Two companies have been formed to participate in the Alberta-to-California gas pipeline proposed by PG & E. Alberta and Southern Gas Co., Ltd., is purchasing surplus Canadian natural gas for the California market. Pacific Gas Transmission Co., of San Francisco, will presumably be the PG & E subsidiary that will operate the line. It is reported that PG & E has shown interest in Washington distributors and their service areas. Meanwhile, Pacific Northwest Pipeline officials expect to deliver first Canadian gas to Washington-Oregon markets sometime in October.

Cuban Gas Transmission Co. has been formed to transmit Mexican natural gas—from the Campeche fields—to Cuba, according to an announcement from Havana. The line would run submerged along the floor of the Gulf of Mexico from the Yucatan Peninsula to the island. It would go overland 150 miles in Cuba to Havana, then submerge again to Florida. Edwin Pauley, Los Angeles oil man, conceived the project. An initial capital of $5 million is planned.

Northern Illinois Gas Co.'s records show 500 cases of damage to their gas piping by contractors, and others engaged in construction work, during the past six months. They are stepping-up a program to urge such concerns to call the gas company for pipe locations before excavating. "We are seriously concerned," said E. D. Sheehan, vice president of operations, " . . . and have instructed our personnel to go all-out to get the cooperation of contractors working in the area."

Look for the announcement soon of the entry of a large electric appliance manufacturer into the gas fired appliance field. This firm has been acquiring some of Servel's expired patents, and is expected to begin making a complete line of gas appliances—including refrigerators, air conditioners, and clothes dryers—next year.

Cleveland's East Ohio Gas Co. will soon take over operation of the Lake Shore Gas Co., Ashtabula, Ohio. Sales agreement has already been reached, and actual transfer will be made after various governmental regulatory bodies have given their approval. Lake Shore Gas serves 15,000 domestic customers in northeastern Ohio. Also included in the agreement is the acquisition of Lake Shore Pipe Line Co. by Consolidated Natural Gas Co., New York, East Ohio's parent company.

Municipally owned gas companies in the U. S. ran in the red again in 1956, the Department of Commerce reports. City and county owned gas systems recorded revenues of $127 million in 1956, against expenditures of $128 million. In 1955, the municipal systems took in $104 million, and spent $125 million.

Texas — the state noted for doing things big — really has something to brag about in Dallas' new Exchange Park, a "city within-a-city." Everything in the development—including the sidewalks—will be air conditioned with gas. Lone Star Gas Co. estimates that the 120 acre project will use one billion cu ft of gas a year. When completed, Exchange Park will have 13,000 tons of air conditioning equipment. The developers now are considering a plan to generate their own electricity, using gas fired generators.

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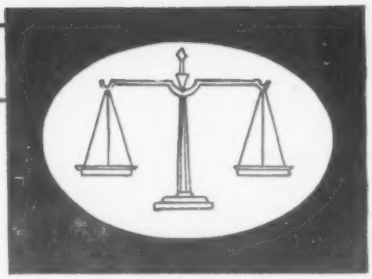

Inferior use of gas for boiler fuel continues

A COURT recently affirmed a Federal Power Commission order authorizing an interstate natural gas pipeline company to sell more than 14 billion cu ft annually to an electric company for boiler fuel in its power plant. The debate over the inferior use of our depleting natural gas resources for boiler fuel to replace coal or oil continues to be torrid. With the Senate's confirmation of Commissioner Kuykendall for another term on the FPC, a majority remains for approval of gas for boiler fuel. The FPC majority in the Black Dog electric generating plant case asserted that "such a sale should be permitted only on a positive showing that it is required by the public convenience and necessity." An FPC majority reversed an earlier order denying the $131,000 connecting pipeline and sale of gas for boiler fuel.

With recent optimistic estimates of the future natural gas supply in the United States, conservation of gas for the superior uses of residential customers may retreat farther. Mr. Terry and Mr. Winger of the Chase Manhattan Bank in New York have estimated that future recoverable gas reserves to be discovered in this country will total 984 trillion cu ft. Added to the existing proved gas reserves of 238 trillion, the grand total will be more than 1200 trillion cu ft in the United States. The present use of about 10 trillion cu ft annually is estimated to double by 1985.

Other observers have emphasized that 10 years ago gas reserves were 32 times the annual production and utilization. In 1956 this life index of the remaining recoverable known gas reserves had declined to 22 times the 1956 production in this nation.

It is enlightening to read the FPC majority's latest opinion in the Black Dog power plant case. Three commissioners gave these reasons for authorizing Northern Natural Gas Co. to sell a large volume of gas to replace coal as boiler fuel in the Black Dog electric generating station of Northern States Power Co. near Minneapolis:

"Upon a study of the complete record and in consideration of the nature of the proposed interruptible sale, we now find that Northern's gas supply as shown by the record is sufficient to support the authorization of the certificate applied for. We further find that the price which Northern will receive for the gas is sufficient to assure a recovery by Northern in excess of a proper allocation of the cost of this transaction and that the private interest which might be adversely affected by this competitive sale must yield to the public interest requiring the issuance of a certificate of public convenience and necessity.

"The facts establish that the proposed authorization satisfies the conventional and basic requirements of public convenience and necessity. The requirements of the Black Dog power plant furnish an adequate demand for the service proposed by Northern. The facilities proposed are adequate to render the service proposed, and the estimated costs of the facilities are reasonable. Moreover, Northern can finance the proposed facilities, and the proposed service is otherwise feasible.

"In addition, in its application for rehearing, Northern points out with greater certainty the benefits to its own operations and to its customers which will, we consider, redound to the benefit of the public and which when added to the other circumstances of this case, outweigh such detriments as may accompany the proposed sale. In this connection, the service proposed will materially improve the load factor on Northern's system. In addition, the service proposed will yield substantial additional revenues which may result in favorable effects upon Northern's rates for gas sold to its present customers. Also, by reason of the proposed sale, Northern States will realize significant savings in its fuel costs, with possible beneficial effects upon its rates also.

"As to the matter of gas supply, in its application for rehearing Northern calls to our attention the fact that Northern's position is generally no less favorable than that of several other companies to which we have recently granted authorizations of a similar character. Of course, Northern, like all natural-gas companies, is probably faced with an eventual deficiency of natural gas, but the circumstances of this case afford no basis for treating Northern differently from others; nor do the particular facts here of themselves establish a present urgency of a gas supply problem to Northern or its customers. Furthermore we can make provision to help meet any problem which may arise in this regard by requiring the future curtailment of the use of the facilities for which authorization is sought if at some future time it is demonstrated to us that public convenience and necessity make this necessary. This condition, which of course was not contained in our earlier order, will, we consider, materially assist in removing the disadvantages that previously influenced the denial of the authorization, an authorization

*A monthly commentary on national and state developments by an expert in the field of utility law.

which otherwise, as detailed above, has many desirable aspects."

Northern Natural claimed that FPC should not consider the inferior and superior uses of natural gas. Commissioner Connole, who was against the sale of gas for boiler fuel, asserted that such a contention lacked merit. He declared that "We have long held that considerations of conservation, inferior and superior uses, and related matters are relevant to determining whether the public convenience and necessity require the issuance of a certificate under Section 7 of the Act." Commissioner Connole cited past FPC decisions. One denied the sale of gas for boiler fuel when the natural gas company's resources were depleted to the extent that the commission said that conservation should be pursued to save the gas for domestic, commercial and superior industrial uses. In another case FPC asserted that natural gas was more desirable for an underground storage program than for use as boiler fuel. Commissioner Connole thought that the price to be charged for the gas in the non-jurisdictional sale for use in the power plant was too low and would cast a burden on the remainder of the natural gas pipeline company's customers.

The United States Court of Appeals for the District of Columbia recently reviewed the order of the FPC which had approved the sale of natural gas for fuel to make steam in a power plant. The court affirmed FPC in this cogent statement:

"The petitioning coal interests ask us to set aside an order of the Federal Power Commission which will enable Northern States Power Co. to purchase natural gas on an interruptible basis for use as a boiler fuel at its Black Dog Lake electric generating plant in Minnesota. The order in question granted to Northern Natural Gas Co. a certificate of convenience and necessity authorizing the extension of its facilities over the short distance between its pipeline and the Black Dog station.

"The petitioners complain that Northern Natural failed to make on the record of the proceedings the necessary showing that such gas service is required in the public interest, or that the price proposed for the sale would return its properly allocable costs. They also say they were unlawfully deprived of a fair hearing because the commission relied on matters covered in independent proceedings relative to jurisdictional sales, in which proceedings the petitioners were not eligible to participate.

"Evidence in the record supports the commission's findings that Northern Natural has an adequate supply of gas from which to make the newly authorized deliveries; that the sales thereof will lower Northern Natural's unit costs by improving its load factor, and will reduce the fuel costs of Northern States to the ultimate benefit of its retail customers. The record also supports the commission's finding that Northern Natural will derive a net profit from the Black Dog sales after the deduction of the incremental cost of service specifically attributable thereto. The fact that the proposed price to Northern States will exceed Northern Natural's established commodity charge was a sufficient check on the direct evidence upon which the finding was based. An allocation of system-wide costs was unnecessary in the circumstances.

"Since the order under review was based on findings sustained by evidence, and since we perceive no procedural error prejudicial to the petitioners, we are not authorized to interfere with the commission's evaluation of the public interest, the making of which is committed to its judgment."

The court pointed to the great and exclusive authority of FPC to appraise the public interest aspects of proceedings for gas certificates of public convenience and necessity. If an applicant wins before FPC the courts will not reverse a decision sustained by evidence. ■

SoCounties links old-world community to system

IN the Santa Inez valley north of Santa Barbara, Calif., is the quaint old-world community of Solvang, a town originally settled by Danes. The succeeding generations have maintained the Danish tradition with simulated store fronts and Danish costumes. This community and the neighboring town of Buellton, are just receiving their first deliveries of natural gas from Southern Counties Gas Co. SoCounties is spending close to $300,000 on the 18-miles supply and distribution system. Initially, more than 250 residential meters and 90 non-residential installations will be served. In the photo, two young Danish-costumed residents of Solvang watch the SoCounties crew complete installation of the new meter and regulator station.

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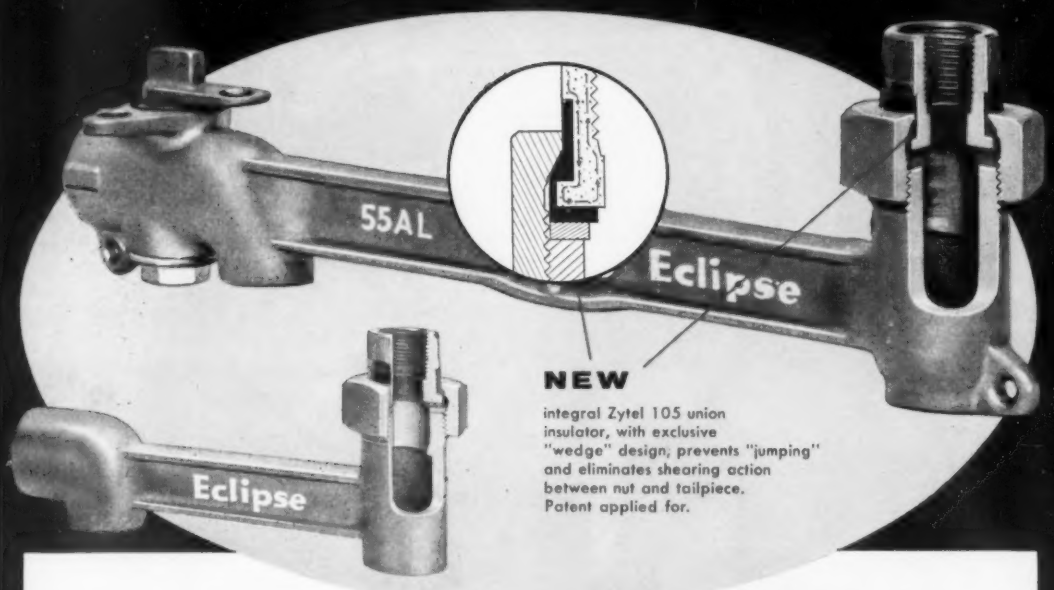

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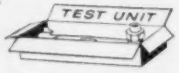

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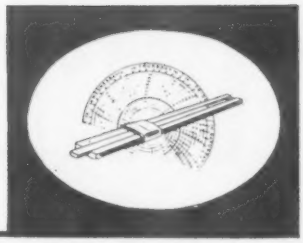

By GUY CORFIELD

The realm of infrared

The region in the electro-magnetic spectrum, extending from just below visible deep red light through to the microwave or short radar frequencies, is termed the infrared. Expressed in wave length, these rays have a length of about 0.7 to 100 microns. A micron is 1/50,000 of an inch in length. These rays can be identified by either wave length or frequency, as one is the numerical reciprocal of the other. They might be considered as heat rays, because they convert to heat when absorbed by an object which they strike. The medical "heat" lamp, which gives practically no light but produces beneficial heat deep into living tissue, is an example of the effect of these rays.

Any object at a temperature above absolute zero gives off radiation corresponding to its temperature. It follows that objects that are at temperatures different than their immediate surroundings will give off radiation different from the surroundings. Furthermore there is at least a slight temperature difference between practically all objects because of differences in heat absorption and emissivity. This is what makes possible "black" or night photography. The rays from a landscape cannot be seen, but to an infrared sensitive photographic film they present a clear picture. Extremely sensitive heat wave detectors have been developed, which for military use permit night observations and maneuvers, the detection of a target and direction of a homing missile.

In chemical research and production analysis, infrared is rapidly becoming a basic and versatile tool. All matter, and combinations of matter, vibrate with characteristic frequency, within the same range as infrared radiation. Also if infrared rays of a given frequency or wave length are passed into and through a substance containing matter vibrating at the same frequency, this matter will absorb at least part of the rays so that they will not pass through. At least a million different chemical elements and compounds have been cataloged as to their infrared absorption characteristics or "spectrum." Therefore, many substances or materials can be analyzed with great rapidity and accuracy by observing which infrared wave lengths are absorbed by them. The apparatus developed for this is termed the infrared spectrometer. It consists essentially of an electrically heated rod to produce the rays; an optical system to separate the frequencies, pass them through the sample to be analyzed, and direct them (less the amount absorbed) to a detector; and the detector which converts the rays into electric impulses. The instrument automatically converts the results into significant motion which is imparted to the needle of a dial or the pen of a chart recorder.

A typical instrument of direct interest to the gas industry is one to measure the carbon monoxide content of air or flue gases. It is made by the Mine Safety Appliances Co. and called the LIRA (Luft-Type Infrared Analyzer). It can be obtained either recording or indicating and with a variety of scale ranges. It is sensitive to 0.001 per cent carbon monoxide. Two hundred determinations can be made in a working day. The AGA Laboratories have recording models which are giving very satisfactory service. This instrument is a far cry from the slow and laborious "iodine pentoxide" apparatus of 20 years ago!

Other gases can be similarly detected—for instance, methane and carbon dioxide. Air and water pollutants can be measured. The chemical and petroleum industries use the principle to control processes and the purity of product streams. Researchers employ infrared for exploring the structure of new materials.

As is the case in many of our amazing modern technical marvels, infrared radiation is not a new concept. Its existence and principles were known 150 years ago. Its present application involved the imagination to put it to use; also the coincident development of instruments and mechanisms such as a thermocouple that can now be made to detect radiation causing a heat rise of one millionth of a degree and an electrical signal of one billionth of a volt.

Versatile new refractory

The Carborundum Co. now makes silicon carbide high temperature refractories by a new method which results in a greatly improved material and flexibility of production and shape. Previously the bonding medium for the silicon carbide grains was itself not very heat resistant nor able to withstand thermal shock.

Now a preformed shape of silicon powder and silicon carbide grains is heated to high temperature in an atmosphere of nitrogen. The silicon and nitrogen react to form silicon nitride (Si_3N_4), which bonds the silicon carbide grains and is itself an excellent refractory material.

The product is called Refrax. It can be turned out with dimensional accuracy of plus or minus 0.003 in./in. without machining. It is possible to form it into a variety of shapes, other than bricks, which can replace some parts formerly made out of metal where resistance is required to high temperature and corrosion and erosion.

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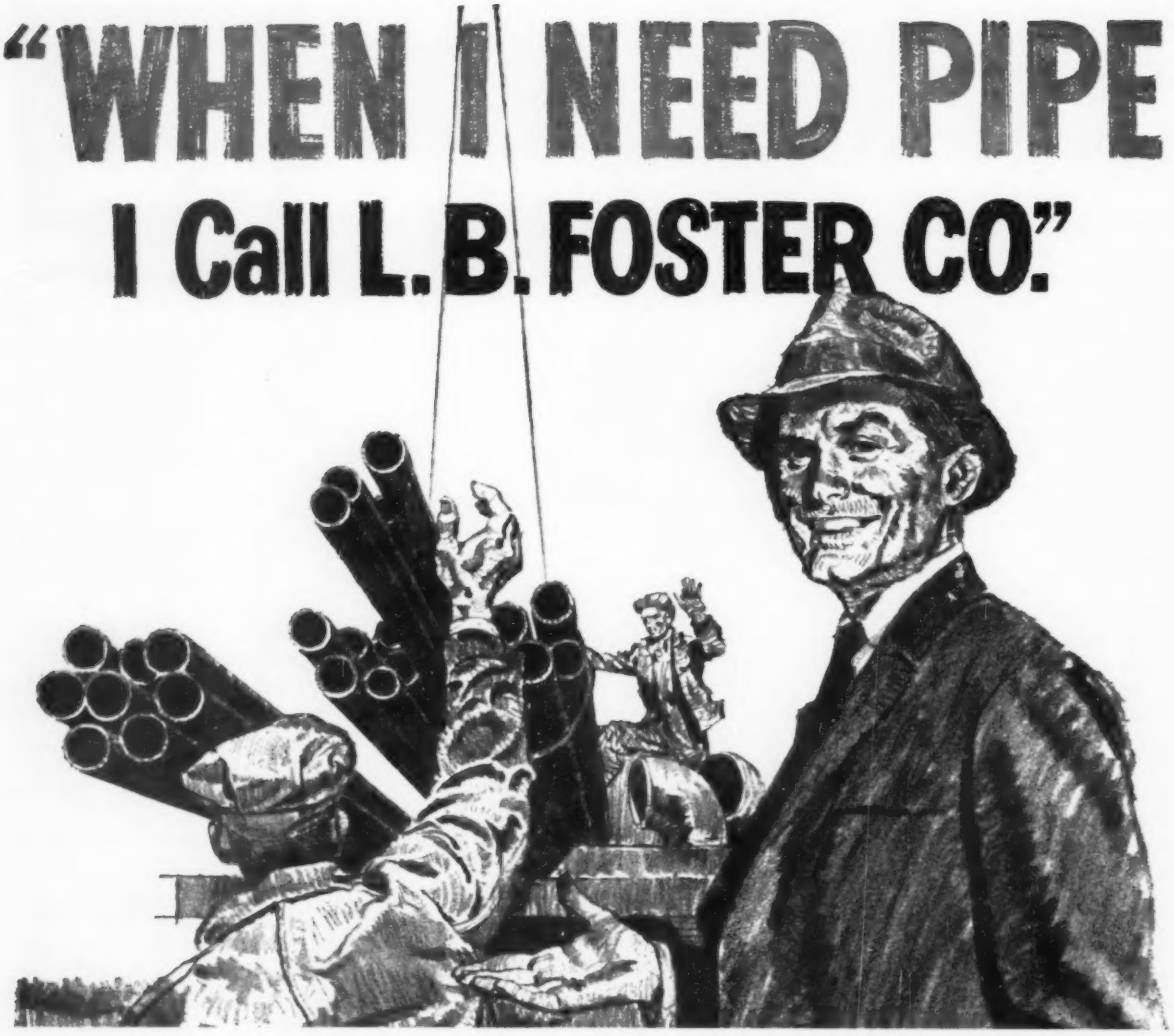

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WASHINGTON

Gas bill backers seek bi-partisan support in '58

by **NEIL REGEIMBAL**
GAS Washington Bureau

DECISION of congressional leaders to delay a vote on the highly controversial natural gas bill until next year was caused by several factors, but not a fear of defeat as such.

Congressional sources say that various polls taken during the final month before adjournment indicated a vote on the Harris-O'Hara bill would be close, but that it would pass.

One of the principal problems facing the Democratic leadership of the House—who favor the bill—was that the polls indicated too much of an imbalance between Democratic and Republican support. When the bill passes, they hope for about a 50-50 split between the two parties in the lineup of "yeas" so the measure can be labeled bi-partisan legislation.

There were other factors involved in the decision to delay a vote. As the session ground through August, more and more members were ready to head for home or vacations, and an increasing number were "playing hookey" for a few days or a week at a time. In addition, opponents of the bill could be more easily marshaled for a vote since most of them live in the consuming areas of the East, closer to Washington than the supporters.

Many supporters were ready to "raise cain" if the controversial bill had been brought up and long debate developed which would have further delayed adjournment, one top congressional leader admitted.

Thus the decision to delay a vote for a year was a matter of taking the lesser of two evils.

House Speaker Sam Rayburn (D.-Texas) says publicly that the bill will have a "much better chance" of passing next year than it would have had in the final days of this session. Rep. Oren Harris (D.-Ark.), co-sponsor of the bill, agrees.

But there is some feeling among other supporters of the measure, which would relax controls over natural gas producers, that it would have been better to lay politics aside and take the bill while the chance was available.

These sources grumble that 1958 is an election year, and many congressmen facing a close political fight for re-election will be wary of supporting any legislation bearing even a faint taint of anti-consumer charges.

There is also the fact that while proponents will have time to drum up a little more support, opponents will have the same opportunity, and there is some belief that in the extra time the opponents are likely to pick up more votes than the proponents.

Finally, the problem of time becomes more serious next year. While the bill remains right where it is during this adjournment, because it is between the first and second session of Congress (two years), if the bill is not passed and signed by the President next year, it is dead. Supporters would have to start over again in the House in 1959.

So while on paper, the bill's chances appear good next year with Rayburn claiming enough votes to pass it in the House and the general belief that there is enough support in the Senate to pass it with little trouble, there are several possible places for short circuit to develop and kill the bill.

Gas industry forces favoring the bill are picking up *unexpected support from the organized farm lobbies for the bill.* In the past, the farm bloc has been generally so-so about the bill. In recent months, however, they have been actively urging passage because they realized that much of the land on which gas is produced belongs to farmers. Whether this support will turn into any new votes in either the House or Senate in favor of the bill is open to question, however.

Politically, the gas bill situation dictates to cautious optimism for supporters, with a lot of hard work ahead, and an outside chance of success for opponents.

* * *

GAS distributors—and others in the industry—are becoming increasingly concerned over the failure of state regulatory agencies as well as the Federal Power Commission to provide rates which adequately compensate for the sky-high cost of borrowed money.

Over the last year, interest rates have shot up about 1 per cent on average utility financing. A recent study of long-term financing by telephone and gas utilities in 1957 shows the cost of mortgages and debentures running anywhere from 4.24 per cent to as high as 6.33. The gas firms generally found their interest charges higher than the telephone utilities.

The high cost of borrowed money, coupled with the long delays of most regulatory agencies in acting on rate increase requests, are costing distributors millions of dollars a year.

One of the factors pushing the cost of utility financing even

Continued on page 198

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THE ROCKWELL

GAS REPORT

DEVOTED TO THE INTERESTS OF THE GAS INDUSTRY

VOL. 2 OCTOBER 1957 NO. 3

A GEM OF A FABLE

Once upon a time there was a small village. In this village there lived people much like you and I. It came to pass that one day the village millers fell to talking amongst themselves, wondering at great length wherein they might sell more flour to the bakers.

When the bakers were told of the millers' desires, they replied most logically that they could indeed buy not a dram more flour unless they could sell more bread. Whereupon many of the millers devoted but a little time, effort and coin to telling the populace the virtues of the bakers' products. Then all the populace did indeed consume more baked goods—then the bakers required more flour—then the millers, well, the millers lived happily ever after.

Moral: *In the gas business, too, both suppliers and utilities will benefit by "selling" gas to the consumer. Now is the time to earnestly support the Gas Equipment Manufacturers' program.*

ROCKWELL MANUFACTURING COMPANY
Pittsburgh 8, Pennsylvania

"LET'S EXAMINE SOME NEW METER STANDARDS!"

Lou McGowan, Chief Engineer, DuBois Division, Rockwell Manufacturing Co.

The gas mantle light is now just a dim memory. But, gas meters are still considered by many to require the same standards set when gas was sold almost solely for illumination. Applying out-dated standards, it is easy to see why modern gas meters seem "over rated." Certainly, today's aluminum gas meters operate at speeds in excess of "horse and buggy" meters, but the suggestion that they are overworked and will fail after comparatively short life demands a close examination of facts.

When gas meters were originally designed and manufactured in this country, they were intended for the measurement of manufactured gas. This gas was used almost exclusively for illumination. While the gas meters have changed very little in basic principles of design, the gas and the applications for the gas have changed tremendously. Water gas or coal gas used in those days was "dirty" and corrosive; modern natural gas is scrubbed and dried at several points on its journey from the well to the burner tip . . . it's a "clean" gas. So, the gas meter which at one time was required to have large diaphragms and heavy valves to overcome "dirty" gas conditions may now be replaced by lighter, smaller aluminum die-cast meters.

Determining Capacity

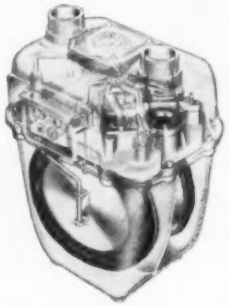
For example, let's consider the Rockwell #415 Meter. This meter is badged at a rated capacity of 415 feet. This means that at a difference of ½" water column pressure between inlet and outlet, the meter is passing 415 cubic feet of .6 specific gravity gas. The capacity of a meter is therefore a function of the differential pressure across the meter . . . *not* simply the speed at which the meter operates. Design-wise, the meter can be increased in capacity only by decreasing internal resistances to the flow of gas through the meter and by reducing parts friction. This may be accomplished in any or all of the following ways:

1. Diaphragms may be made lighter or more flexible.
2. Bearing points may be redesigned to decrease friction.
3. Resistance to gas flow may be improved by redesigning the flow channels through the meter . . . in particular, through the valve plate.

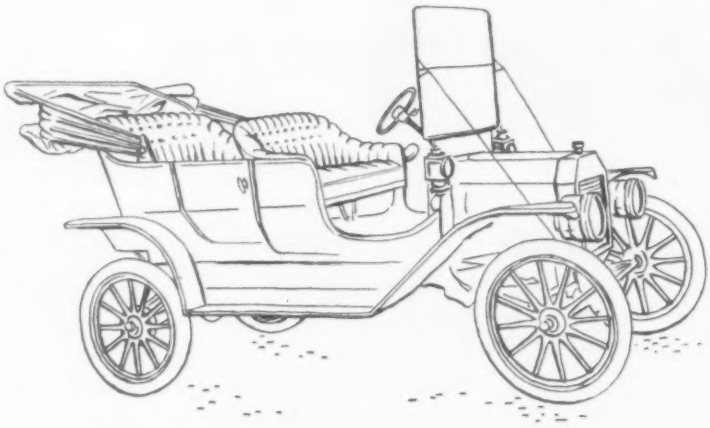
In discussing further these three possibilities for increasing gas meter capacities it should be pointed out immediately that the diaphragms have been tried and tested in their present design for many years. At this time, it is reasonable to assume that little improvement may be expected in diaphragm designs.

Bearing points have, in the newer meters, been changed to lubricated powdered bronze bearings. These new bearings have considerably reduced friction on bearing points and thereby increased gas meter capacity.

Perhaps the biggest factor in the increase of gas meter capacities is the improvement of the flow channels through the valve plate. In the newer meters, all obstacles and sharp points in the flow channels have either been removed or greatly streamlined. Ample area has been provided for smooth gas flow and the 270° turn at the outlet of the meter has been eliminated.



Modern meters employ powdered metal lubricated bearings to reduce friction on bearing surfaces and flow passages are as streamlined as a guided missile.



This 1902 Ford wasn't nearly so fast or efficient as the 1957 models are . . . the same idea applies to gas meters. It's little wonder that modern meters seem "over-worked" when based on 1902 standards.

Basis of Capacity

In discussing further the capacity and speed of meters, it is important that we examine the basis for capacity ratings. Domestic meters are generally considered as being meters of less than 450 cfh. This rating is based on ½" water column differential between the inlet and outlet of the meter. Industrial meters are those meters which have a capacity of greater than 450 cfh, or are rated on a differential pressure of 2" water column. At the time these ratings were established, it was felt that the ½" water column rating for domestic meters was the maximum efficient speed at which these meters could be operated. The reasoning was that above ½" water column ratings, excessive wear would be encountered in the white metal links and bearings. The big meters, or so-called industrial meters, were rated a 2" water column differential because it was felt that they were of heavier construction and were "beefed-up" to resist wear. The fact remains, however, that bearing points of smaller meters (and industrial meters, too) have been vastly improved and are now actually designed to withstand wear at higher operating differentials.

Meter Speed

The #415 Rockwell Meter, at its rated capacity, turns 2,700 revolutions per hour. This is approximately 45 revolutions per minute. To old time meter men this seems like a super-sonic speed. But the question is, "Why was the speed of 120 revolutions per hour for so long considered to be the maximum safe speed for gas meters?" The answer seems to be that such a speed represented the capacity operation of an original 5 Lt. Meter (30 cfh). The old meter which by virtue of its design —tiny valves, small gas ways, inefficient bearing, etc.—really had a maximum safe speed of only 120 revolutions per hour. However, it is virtually impossible to compare the old meter with the new meter and accept the old meter as a basic standard. The parallel which illustrates such a standard is the development of the motor car. One would never dream of condemning the engine speed of an automobile because it exceeds that of a design produced over thirty years ago! In addition, we must remember that the "fast" meter which we are talking about is still only turning a mere 45 revolutions per minute . . . very slow in comparison with a new 235 horsepower automobile engine which puts out many hundreds of rpm and uses *identical* bearing materials which are used in present day meters!

Capacity Operation

A final point in discussing modern meter capacity entails a simple dictionary approach to the word, "capacity" . . . "maximum output" (Webster's). The fact is that the average gas meter operates only a very small portion of the time at its rated capacity. It is probably fair to estimate that the average hourly consumption of a normal domestic consumer is approximately 30 cfh . . . roughly 8% of capacity of the Rockwell #415 Meter . . . and that pressure loss is negligible.

It seems strange that while some technical people are building an earth satellite, others of us are still using gas light era standards of rating gas measurement devices.

NOISE ABATEMENT IN HIGH PRESSURE BALANCED VALVE REGULATORS

Joseph A. Pommersheim, Chief Engineer, Norwalk Division Rockwell Manufacturing Company

On some installations of H.P.B.V. Regulators where noise becomes objectionable because of the location, a very easy remedy has been used. This applies particularly to the Rockwell Type 36-B center guided valve assembly, and is particularly effective on the six inch regulators. On experimental installations of this size, we have found that by installing a baffle plate on the valve stem just below the coupling, the noise has been eliminated entirely or reduced to a level no longer objectionable. The method of assembly is shown in Figure 1. The baffle plate we have improvised is a Rockwell Type 30 Pilot Regulator diaphragm plate with the center hole opened sufficiently to slip over the valve stem. A nut holds the plate in position against the coupling.

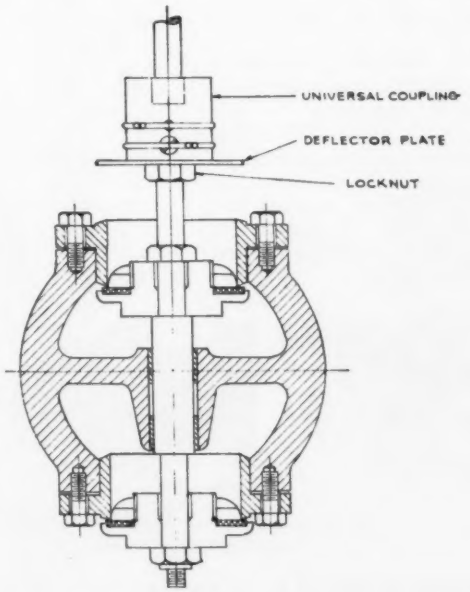


Figure 1

HOW TO SELECT VALVE LUBRICANTS

by R. J. Sarraf, Chief Chemical Engineer, Lubricant Engineering

For more than forty years, the lubricated plug valve has been widely used throughout the gas industry. Although the original lubricated plug valve, invented by Sven Nordstrom, was designed for the mining industry, its principal use has been in gas transmission and distribution.

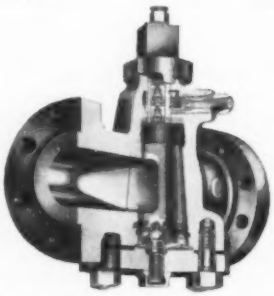
Before selecting lubricants for use in Rockwell-Nordstrom valves, it is well to understand the precise functions of the lubricant. The four prime functions of lubricants in a lubricated plug valve are:

1. To effect a plastic seal between the sliding contact surfaces of the valve which prevents leakage of the line fluid and prevents infiltration of foreign matter between these surfaces.
2. To furnish a fluid medium for lifting the plug from its seat, both to provide a space for the renewal of the lubricant film and to free the plug from its seat if corroded and frozen together.
3. To effect easy operation for the valve by lubricating the sliding contact surfaces and reducing the friction between them.
4. To provide a protection for these surfaces so that the original finish is not marred by corrosion and the turning effort increased, also it prevents the development of leakage due to corrosion of these contact surfaces.

The selection of a lubricated valve for a desired service or class of services should not only involve the consideration of proper valve size, type, and metal construction capable of withstanding the temperature, pressure, corrosiveness, etc., but equal consideration must be given to a suitable lubricant for the particular service for which the valve is to be used. This is a prime requisite, since to obtain optimum operation, the valve structure and plastic sealing film must be considered an integrated unit. In a valve properly adjusted and lubricated with an effective lubricant, the lubricant becomes a structural part of the valve providing:

1. A flexible and renewable seat, thus eliminating the necessity for "force fits" and metal-to-metal contact to effect a seal.

2. A plastic film capable of coating internal valve parts for prevention of galling or seizing, and easing valve operation.



3. The hydraulic jacking force required to raise the plug for facilitating injection of lubricant into the valve.

4. Provision of a coating, protective in nature to the inner valve metal surfaces in contact with line fluid.

5. Other benefits attendant with the use of the Rockwell-Nordstrom lubricated tapered plug valve.

While we call our sealants lubricants their function in a valve is not the same as an ordinary lubricant used to lubricate a bushing or bearing in "high speed" applications.

Sealant used in lubricated valves not only has to lubricate, but also is subject to the solvent power and washing action of the line fluid. In addition, it must operate in abnormally high, or sub-zero temperatures encountered in industrial processing. Thus, in addition to providing the desired viscosity, metal-adhesion, thermal resistance and lubricity, these properties must be maintained in the presence of line fluid. These requirements are exacting since the volume of line fluid may be millions of times the volume of lubricant in contact with it.

As an illustration, Rockwell-Nordstrom lubricants are currently available which adequately function over the complete range of ¼" to 36" Rockwell-Nordstrom valve sizes, and up to the extreme of 15,000 psig working pressure or conversely, in ultra-high vacuum services of 3-5 MICRONS and lower. (1 micron of mercury (32°F) = 1.316×10^{-6} atmospheres.) This means the lubricants selected for these services must have extremely high film strength, low volatility and exceptional lubricating and sealing properties.

Temperature-wise, Rockwell-Nordstrom lubricants are available for service over a range of −150° to 1000° F. The noteworthy characteristics of these lubricants compounded for high temperature service include not only their ability to lubricate and seal under these extreme conditions of temperature, but particularly the fact that they do so without the formation of hard, carbonaceous residues, so often the case with lubricants improperly compounded or selected for high temperature service.

A complete manual on the selection of Rockwell-Nordstrom valve lubricants (including servicing and adjustment of valves) is available. If you would like a copy for your reference files, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa.

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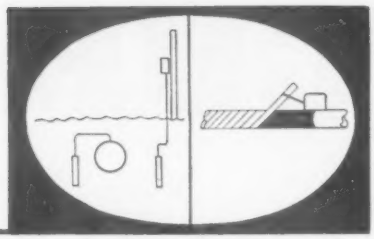


by MARSHALL E. PARKER

Frost and soil resistivity

THE resistivity of the soil is a widely used criterion of its probable corrosiveness, largely because it is relatively easy to measure and because it correlates more closely with demonstrated corrosiveness than any other single factor. The degree of correlation, and hence the usefulness as a criterion, is probably dependent upon the accuracy with which we determine the resistivity *at pipe depth*.

Most commonly used method is the Wenner, or four-electrode, system, because of its ability to obtain values at depth, and because it takes a larger sample of soil than the single-rod instruments. This method is described as giving the "average" resistivity to a depth equal to the electrode spacing used. This is misleading, since actually the reading is influenced by the resistivity of strata at depth, and may be quite different from that representative of the soil in which the pipe lies.

An extreme example is that of any underlying stratum of very high resistivity, such as frost. A frozen layer at a depth of 2 ft will make 1000 ohm-cm soil look like 4000 ohm-cm, when the common 62-in. spacing is used. A non-conductive layer at a depth of 4 ft will make the same soil look like 2100 ohm-cm. The first example cited—frost at 2 ft—could mean that a pipe buried at 3 ft would be spending its summers in a soil whose resistivity is actually only one-fourth of the indicated value; the second, if the lower layer were rock, could mean that a line at 3 ft is spending all of its life in soil with a resistivity double the indicated value.

To a lesser degree, the same kind of error occurs whenever the lower strata have a higher resistivity than the soil near the surface, the soil to which the pipe is actually exposed. This inability to measure accurately the true resistivity of the soil in which the pipe lies causes two difficulties: (1) much

Continued on page 183

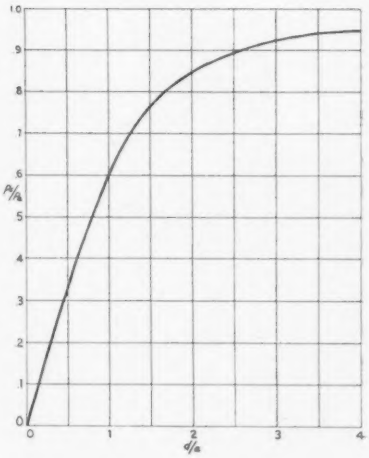


Fig. 1.

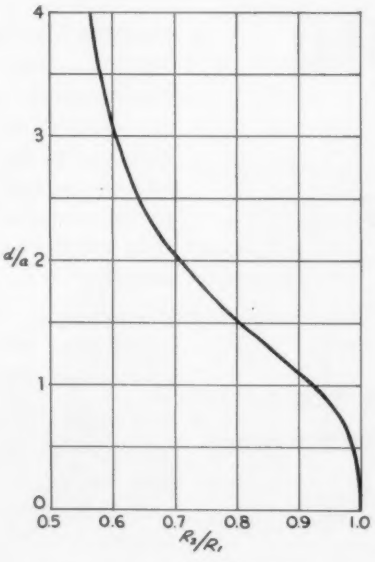


Fig. 2.

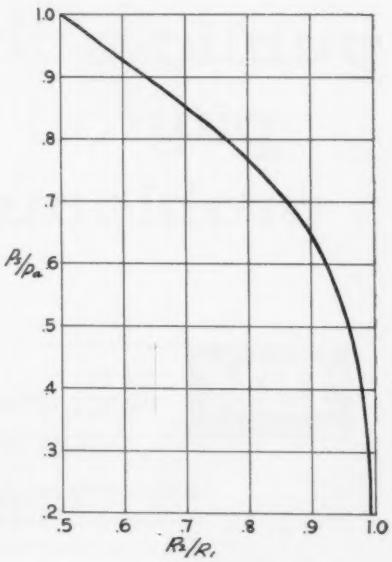
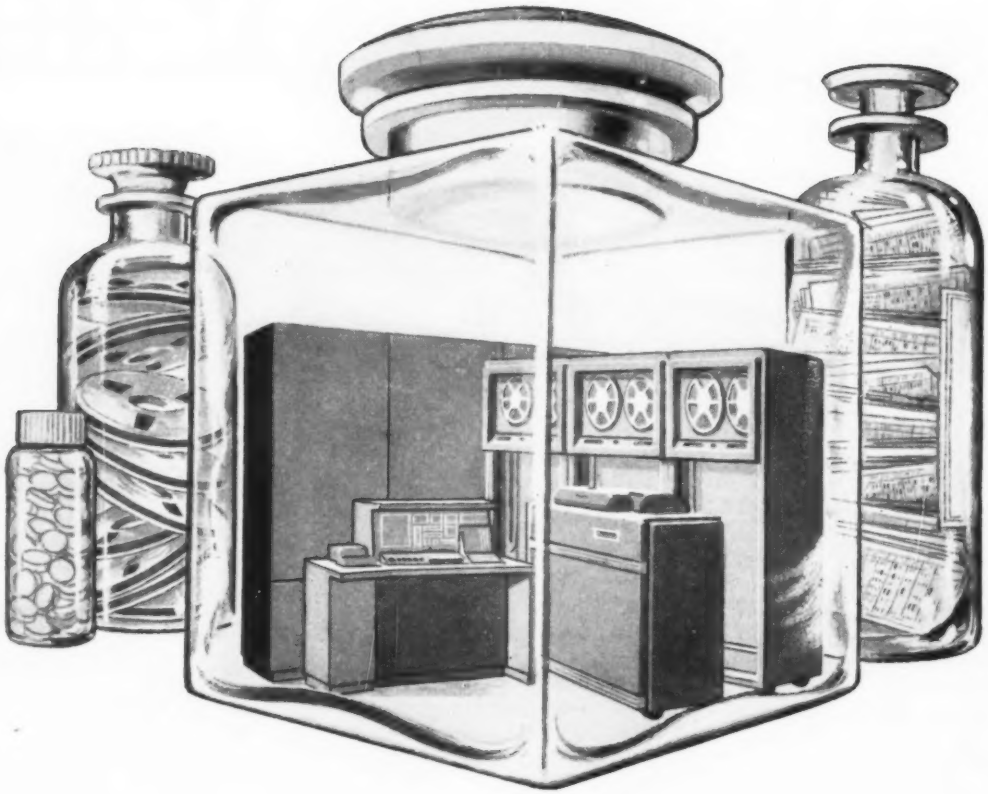


Fig. 3.

CURE...



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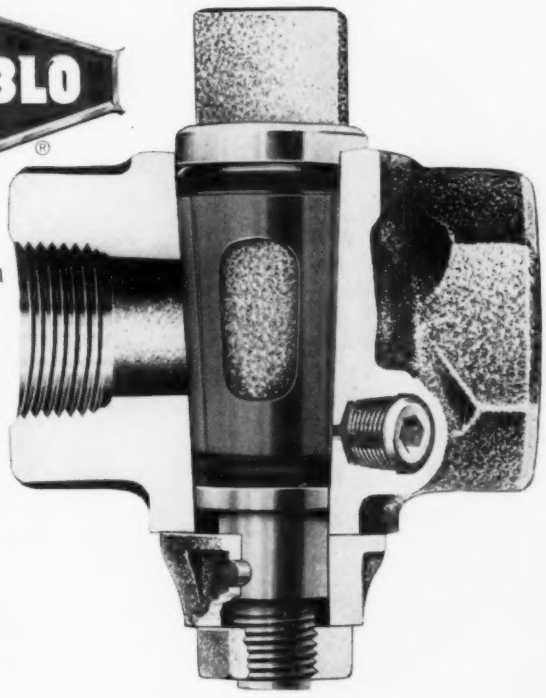

"O" rings located at top and bottom of the lubricated key give double protection against leakage of gas to the atmosphere. Precision ground key is individually lapped into body to prevent leakage through the port when stop is closed.

And the LubOseal is permanently operable. Lubricant is forced in and stored under pressure around "O" rings through an independent port in the body. Lubricant is evenly distributed around entire key each time the stop is operated to insure permanent, easy turning.

Replace inoperable gas meter stops with the LubOseal. You can do it quickly and safely under pressure with the Mueller NO-BLO® Stop Changer. See your Mueller Representative or write direct for complete information.

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H-11175 Lock Wing
Black or Galvanized
Sizes ¾" through 2½"

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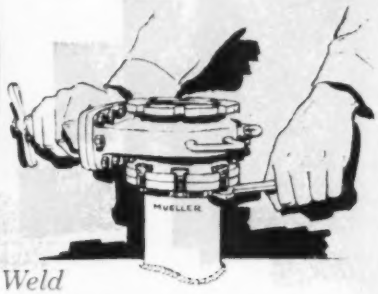
In Canada: Mueller, Limited, Sarnia, Ontario

Abandon lines without abandoning

Mueller® Save-A-Valve Drilling Nipples are ideal for temporary or semi-permanent connections. When lines are abandoned, the exclusive NO-BLO® Completion Plug is inserted into the drilling nipple through the gate valve. The plug effectively holds the pressure while the expensive valve is removed to be used again. A completion cap further seals the nipple against leakage.

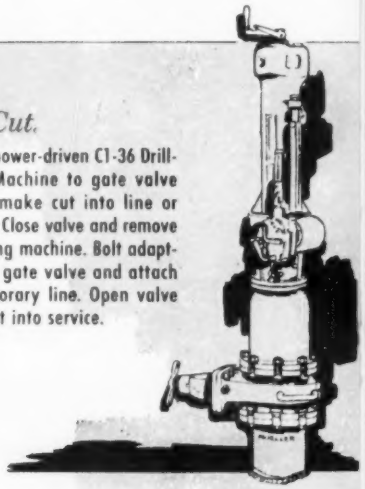


1. *Weld*

Loosen plug so that "O" ring does not touch flange. Position and weld nipple to line or tank. Remove plug, attach test cap and pressure-test welds. Remove cap and bolt open Mueller gate valve to nipple.

2. *Cut.*

Bolt power-driven C1-36 Drilling Machine to gate valve and make cut into line or tank. Close valve and remove drilling machine. Bolt adapter to gate valve and attach temporary line. Open valve to put into service.

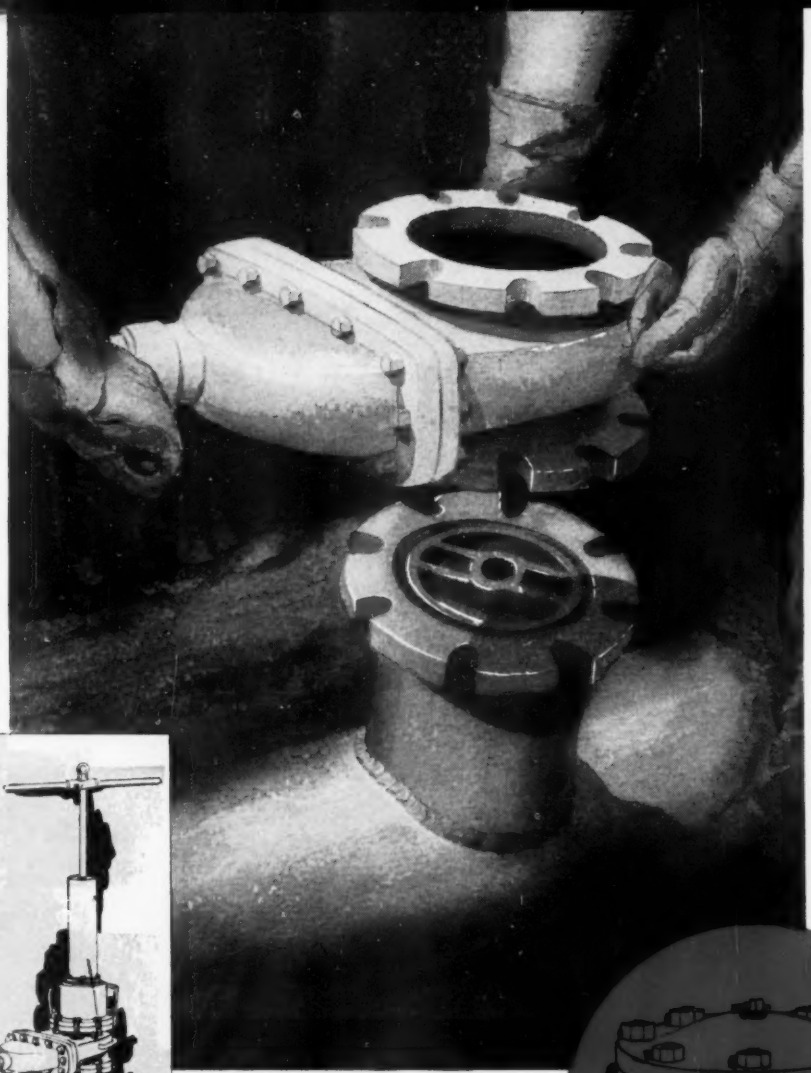


Flanged type nipples have welding inlets contoured to fit pipe one size larger than the nipple. Available in 4″, 6″ and 8″ sizes of varying lengths with 150 pound flanges for pressures up to 230 p.s.i. Optional 300, 400 and 600 pound flanges for higher pressures may be ordered on the 4″ and 6″ sizes.

Smaller Save-A-Valve Drilling Nipples from ¾″ through 3″ are available with welding or threaded inlets and threaded caps. Cast iron caps for pressures to 250 p.s.i.; steel caps to 1200 p.s.i.

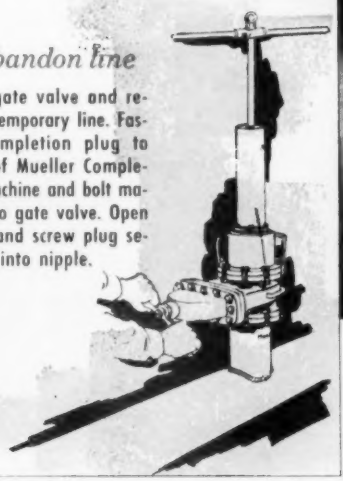
MUELLER NO-BLO® Method

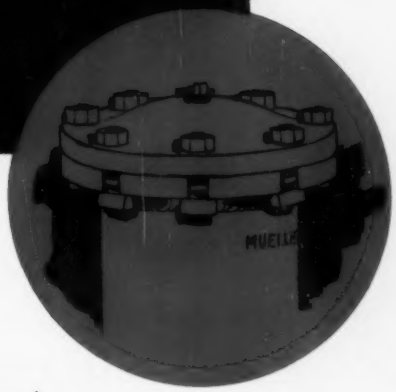
valves



3. *Abandon line*

Close gate valve and remove temporary line. Fasten completion plug to shaft of Mueller Completion Machine and bolt machine to gate valve. Open valve and screw plug securely into nipple.





4. *Recover valve*

Release plug from shaft of completion machine and remove machine. Plug now holds pressure and gate valve may be removed.

5. *Cap nipple*

Place gasket in flange recess of nipple and secure completion cap.

Connection may be re-used any time

Remove cap and bolt gate valve to fitting. Attach new E-Z-Release Plug Extracting Tool to shaft of completion machine and bolt machine to gate valve. Advance shaft of machine to engage plug. Unscrew plug and remove from nipple. Close valve, remove machine and re-attach line to valve.

Write for the No-Blo Method Booklet "Make Installations Under Pressure". It shows how other gas installations may be made in complete safety, without loss of gas or interruption of service to customers.

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Good Everywhere

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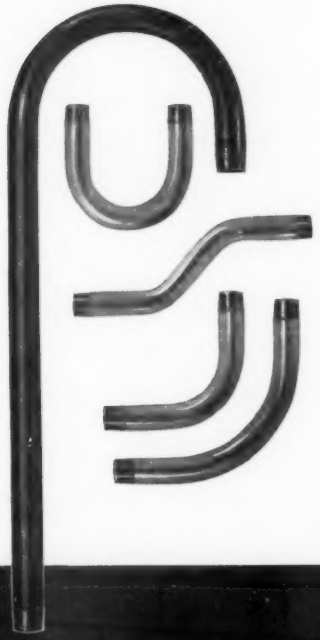
U-Brand Loops and Bends give you faster, safer gas meter installations!



Fewer connections to make . . . less chance of leaks

As you see in the gas meter installations below, use of U-Brand Loops greatly reduces necessary fitting and nipple connections. You get faster, cheaper . . . yet safer meter installations. That's why leading meter manufacturers and gas companies recommend the use of loops and bends.

U-Brand 180° Loops and 90° Bends are available in ½" to 2" diameters with any radius or leg length. Special bends on request. Your choice of galvanized, electro-plated galvanized or black U-Cote finish.

There's a U-Brand Loop or Bend to save you time and money on every meter installation. Buy U-Brand Loops and Bends at your Supply House today!

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Galvanized and Black U-Cote Malleable Iron Pipe Fittings—Unions — Plugs and Bushings — Cast Iron Drainage and Screwed Fittings — Steel Nipples and Couplings — Insert Fittings for Plastic Pipe.

U BRAND

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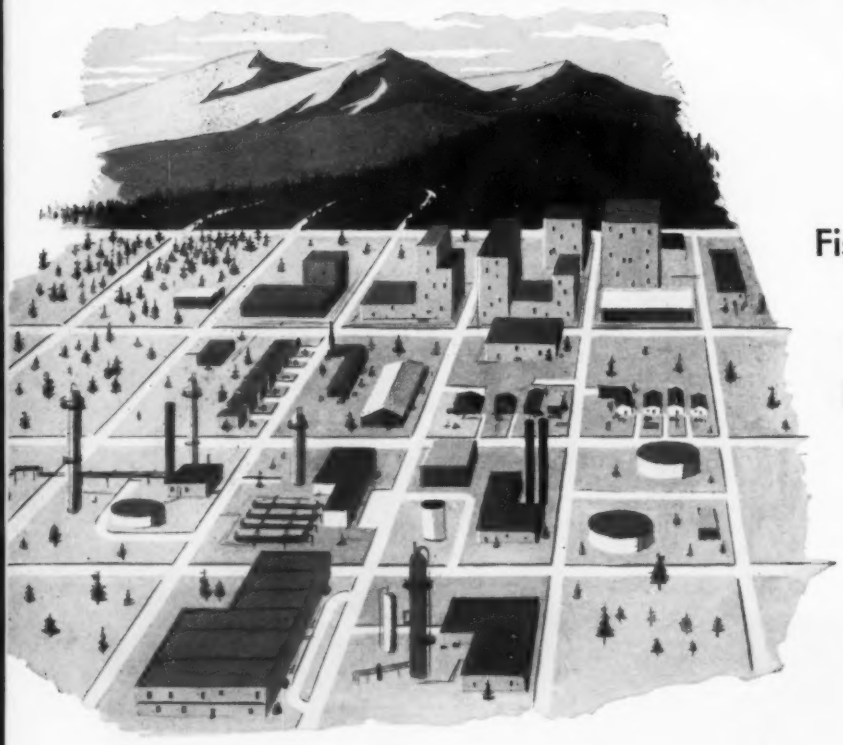
Ashland, Ohio

how Fish Service Corporation helped bring a new age of energy to SPOKANE



From initial Survey to final completion Fish Service Corporation supervised all steps in converting Spokane Natural Gas Company from an obsolete Propane-air utility to a modern, efficient natural gas distributing system.

IN EARLY 1953 Spokane Gas and Fuel Company saw little hope for the future. Sales were declining, the system was obsolete, cash was low, and prospects were so dim new financing was hard to get.

Then, with the promise of Natural Gas via pipeline from the San Juan Basin, things began to look up. But the company had little experience in planning, financing and executing the modernization required to take advantage of the new supply.

The management then turned to experts. Fish Service Corporation was retained to take charge of all phases of the change.

First Fish made a survey. Then, based on that survey, new financing was obtained. On behalf of the company, Fish went before the state regulatory commission and the F.P.C. The system was modernized and enlarged with supervision and inspection by Fish. Rate structures were calculated by Fish, and the company organization was improved. Even the name was changed to the Spokane Natural Gas Company.

Results were gratifying. Demand went up immediately. By December 1957, demand is expected to reach a peak of 37 million cubic feet per day. A sick, declining company had been transformed to a vigorous, growing one.

This may be an extreme example, but Fish Service Corporation may be able to help you, too. Why not call us and find out.

FISH SERVICE CORPORATION

HOUSTON, TEXAS

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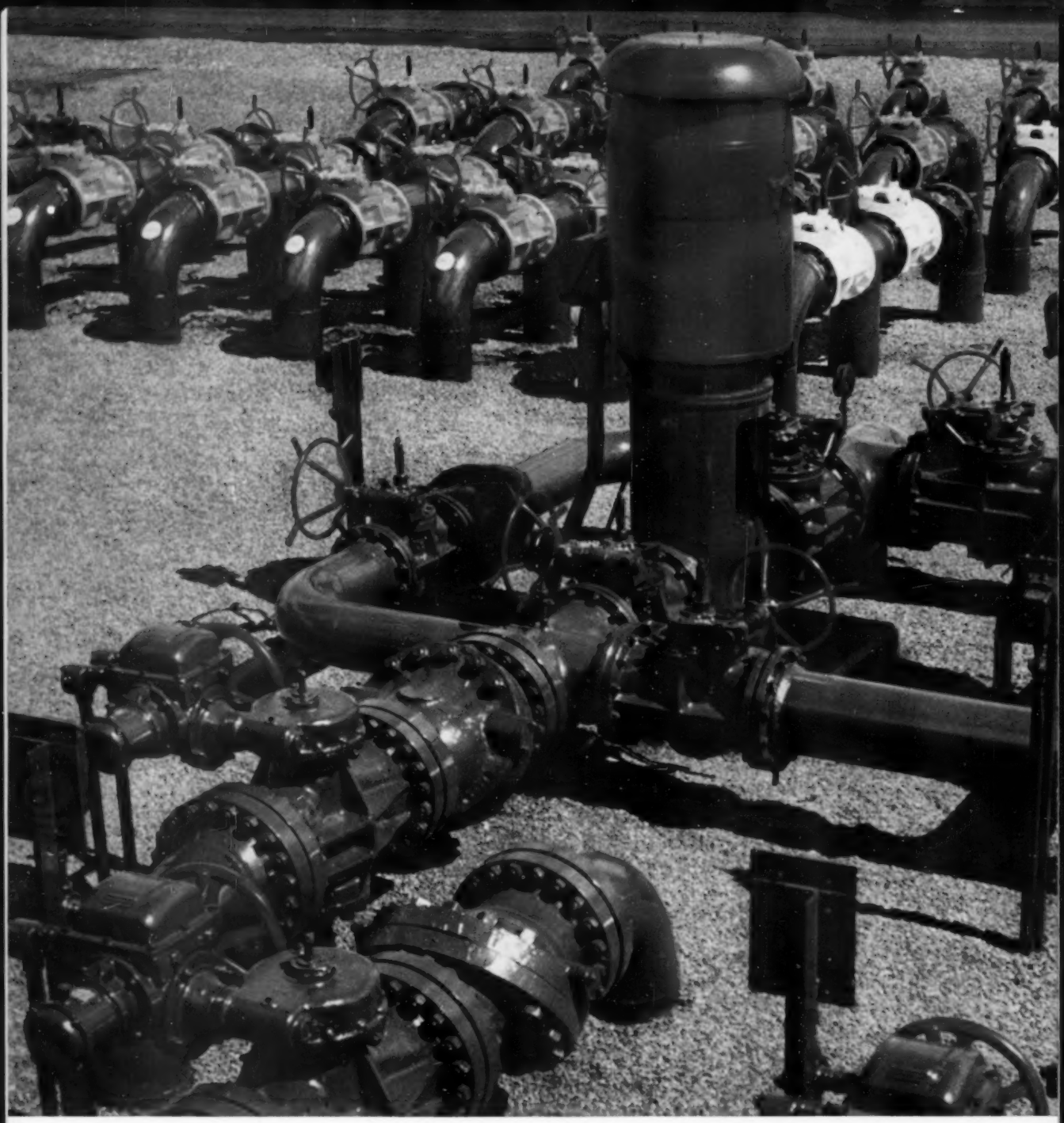
TROUBLE FREE... You can't buy a more trouble-free, leak-proof valve than Rockwell-Nordstrom; that has been proven over the last 40 years. The basic reasons: a durable, *pressurized lubricant* seal holds the lightest gases or heaviest slurries bottle tight. And, *lubricant protection* eliminates metal-to-metal wear —prevents valve failure, keeps maintenance costs lower than any other valve.

Rockwell-Nordstrom, the world's most complete line of lubricated plug valves, will give you better flow control at lower cost everywhere you use them. And they cost no more to buy, often less, than ordinary valves. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed For Positive Shut-Off



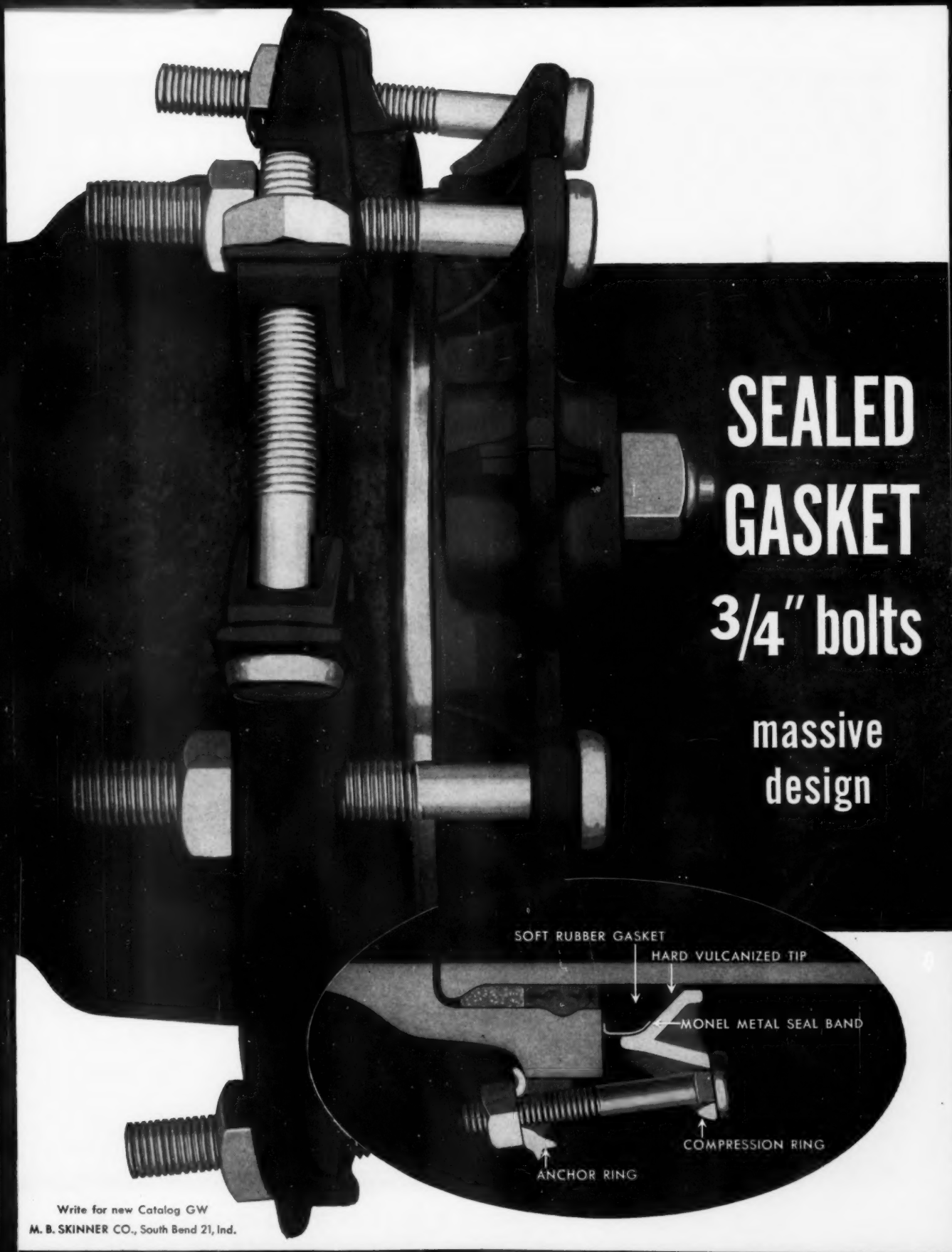
RUGGED Rockwell-Nordstrom valves *stay* trouble-free on pump and compressor lines. Why? Their firmly seated, lubricated plug prevents seat failures that are common to ordinary valves on high pressure or pulsating flow. And even on hard to handle services, shut-off is always positive because a tough film of lubricant forms an instantly replaceable, double seal against leakage.

Rockwell-Nordstrom is the original and world's most complete line of lubricated plug valves and lubricated plug valve accessories. They cost no more to buy, often less, than ordinary valves and they'll save money, give better performance everywhere you use them. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed For Positive Shut-Off



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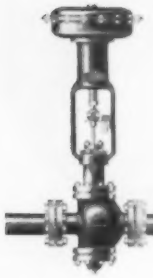
DIA-GRID RELIEF VALVE



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The pilot body is constructed of carbon steel with the inner valve and orifice of stainless steel. Relief pressure ranges on the Type 6301 pilot are 20 to 180 psi. and 100 to 600 psi. The pilot can be changed from the lower to higher range very simply.

Although the Dia-Grid was designed primarily for gas service, it can be used on liquid service if air or gas is available as the supply pressure medium for operating the pilot. Temperature limitation is —40°F. to +150°F.

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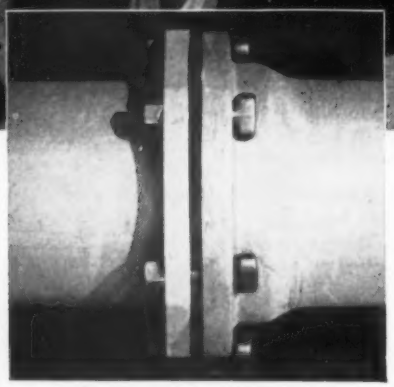
MODERN GAS SYSTEMS



Modernized 12" mechanical joint cast iron pipe being unloaded by the Public Service Electric and Gas Company of Newark, N. J.

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Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, Suite 3440, Prudential Plaza, Chicago 1, Ill.

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Read the facts on its long life, dependability, economy

Many changes have occurred in the gas industry since 40 American cities installed underground cast iron gas mains over a hundred years ago.

But cast iron pipe keeps a step ahead of the times.

Modernized cast iron pipe, centrifugally cast, is even tougher, stronger, more efficient. Its standardized mechanical joints are bottle-tight under all gas pressures . . . and for all types of gas.

Wall thicknesses are uniform. Joint design allows deflection during and after installation. Service connections are easily made. Shorter lengths and ample variety of standard fittings cut time and labor in congested undergrounds.

Add the demonstrated long life, inherent in cast iron. One conclusion is inevitable:

Modernized cast iron pipe is the ideal carrier for *modern* gas systems.

105 Years Old . . . and Still Going Strong!

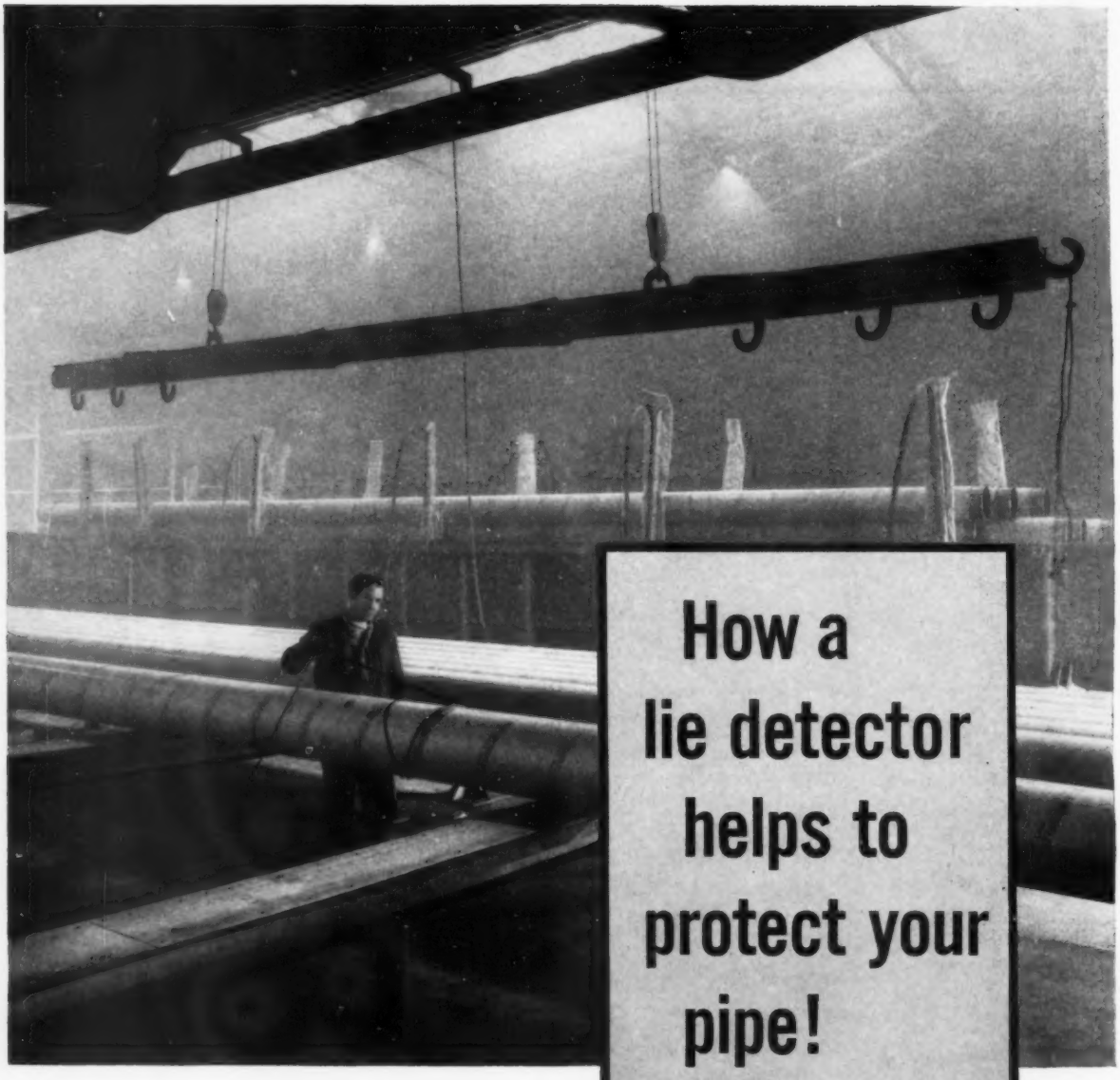
Installed in 1852 this cast iron pipe still distributes gas for the Providence Gas Company, Providence, R. I.

Only Cast Iron Pipe can point to such a typically outstanding service record. And remember, *modernized* cast iron pipe is even tougher.

A FEW OF THE 40 GAS UTILITIES WITH CENTURY-OLD CAST IRON MAINS IN SERVICE

Peoples Gas Light and Coke Co., Chicago—Baltimore Gas and Electric Co.—Philadelphia Gas Works—Richmond Gas Works, Richmond, Va.—Hartford Gas Company, Hartford, Conn.

pipe FOR MODERN GAS DISTRIBUTION



How a lie detector helps to protect your pipe!

Here's one of the many ways we check our own work at Hill, Hubbell. This man is using an electronic "lie detector" on Hill, Hubbell wrapped pipe. Purpose: to find any possible imperfections in the coating which do not show through the outer wrap. Every square foot of pipe is so inspected before it leaves the plant. Pioneered by Hill, Hubbell know-how, the use of the electronic "lie detector" is another first by the first name in pipe protection.

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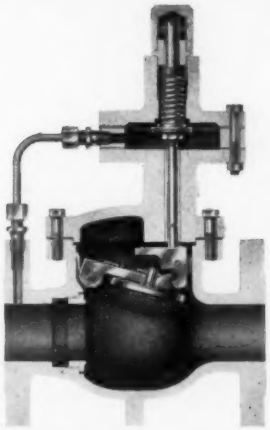
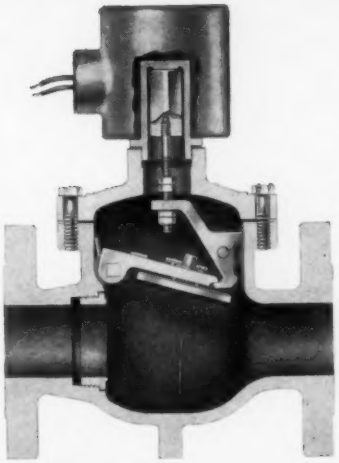
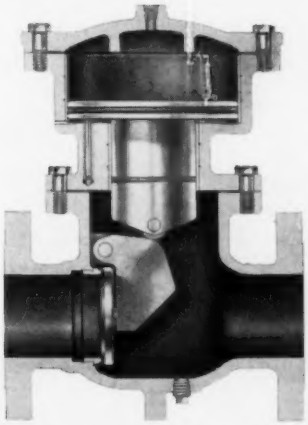


Model 1500H shown, is a high pressure shut-off valve which closes automatically and instantly when predetermined high pressure is reached. With addition of a fusible metal plug, valve can be furnished to shut off on overpressure and/or over-temperature. With control pressure above diaphragm, valve can be made into a low pressure shut-off valve. Combination high and low pressure shut-off also available.



Model 1700 shown, is a Solenoid operated valve normally energized to maintain valve in open position. On interruption of electric current valve closes instantly. Model 1800 Solenoid shut-off valve available to shut off gas instantly by applying electric current either automatically or through a "panic" button.

Instant action, sure and safe with Coppus Sentry® Valves



Model 3000 shown, is a piston operated valve, which opens instantly when pressure above the piston is released. Restoring the pressure above the piston closes the valve. The operating pressure above the piston can be obtained from the line or from an independent source of gas or liquid and can be automatically released or applied by instrument air or gas operated pilots or by use of a small three-way Solenoid valve.

Sentry Valves assure better protection of personnel and property. Instant, split second action with full flow, available in two basic types. Sentry Latch type valves for instant automatic closing; Sentry Piston type valves for automatic opening and closing.

The Latch type requires manual reset — the piston type can be opened and closed automatically.

Sentry Valves can be actuated by high or low pressures, by excessive temperatures, by excessive flow or electrically by use of a Solenoid.

Standard sizes — all Full-Flow — in steel or meehanite 1½" to 8".

To get more detailed information on this outstanding line of Coppus Sentry Valves send the coupon.

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"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORPORATION
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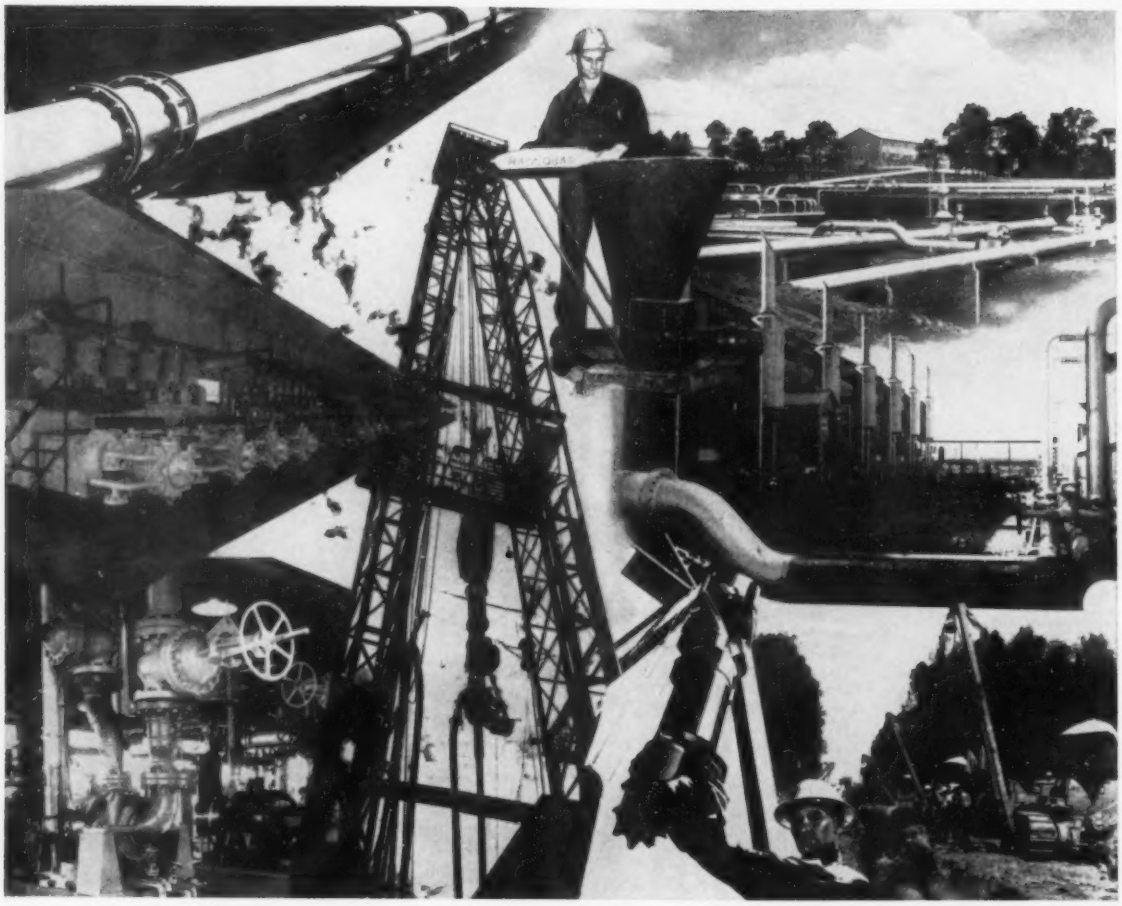

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CLARK BROS. CO., Olean, New York —Gas turbines, engines, and reciprocating, centrifugal and axial flow compressors—gas, steam, electric and diesel driven.

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DRESSER MANUFACTURING DIVISION

DRESSER MANUFACTURING DIVISION, Bradford, Pa.—Pipe line couplings, pipe repair sleeves and clamps, weldments, forgings, welding fittings, flanges, rings.

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THE GUIBERSON CORPORATION, Dallas, Tex.—Swabs, packers, anchors, workover equipment—drilling heads, blowout preventers, tubing blocks, hooks, swivels, kellys, savers, unions. Gas lift equipment. Molded rubber products.

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IDECO, Dallas, Tex.—Hydrair* and Power Rigs; Full-View* Masts; substructures; single, dual and Drive-In Rambler Rigs; blocks, swivels, rotaries; mud pumps; petroleum equipment and supplies.

LANE-WELLS

LANE-WELLS CO., Los Angeles, Calif., Houston, Tex., Oklahoma City, Okla.—Electric and Radioactivity Well Logging, Koneshot* perforating and bullet perforating, packers and bridging plugs.

Magcobar

MAGNET COVE BARIUM CORP., Houston, Tex.—Magcobar* and Magcogel* drilling muds and other specialized oil well drilling fluids and chemicals.

PACIFIC

PACIFIC PUMPS, INC., Huntington Park, Calif.—Centrifugal pumps for refineries, power stations, pipelines, and chemical plants; plunger pumps for oilwells.

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ROOTS-CONNERSVILLE BLOWER DIVISION, Connersville, Ind.—Rotary positive blowers, gas pumps, centrifugal blowers, exhausters, vacuum pumps, and positive displacement meters.

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SECURITY ENGINEERING DIVISION, Dallas, Tex., Whittier, Calif.—Rock bits, reamer rock bits and hole openers; reamers, casing scrapers and Neo-Rod rubber stabilizers.

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WELL SURVEYS

WELL SURVEYS, INC., Tulsa, Okla. —Nuclear and electronic research and development for the petroleum and other industries. Originators of radioactivity logging.

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You receive a bonus of extra value whenever you are served by any one of the Dresser companies. *Men with imagination* provide the research, engineering, manufacturing and service applications for the particular specialties of each Dresser operating unit. All Dresser companies work together with their combined experience and facilities to form the world-wide Dresser industrial team. This inter-company teamwork offers a bonus in greater experience and technical knowledge—backed by the extensive Dresser facilities—in the customer's specific industry. This intangible but important factor is known the world over as the Dresser plus+ . . . the mark of superior equipment and services for the oil, gas, chemical, electronic, and general industry.

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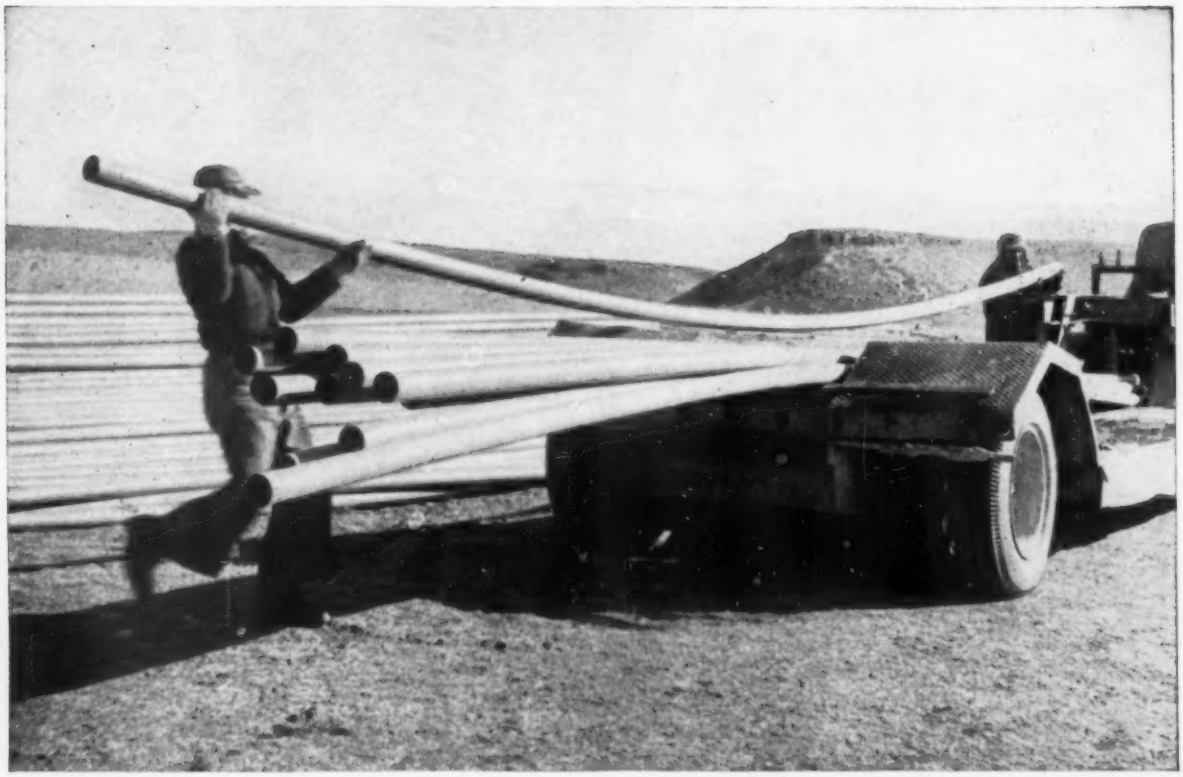

Easy to Handle . . . *Geon pipe weighs only 1/5 as much as steel pipe of similar size. This lightness saves shipping costs, too.*

Now it's easy to stop piping corrosion

Fast Assembly. . . *Pipe is joined with fittings and solvent cement. A sound joint can be made in less than a minute.*

. . . install Geon rigid vinyl

YOU can now obtain rigid vinyl pipe and fittings made of Geon polyvinyl materials from leading manufacturers. This remarkable plastic is immune to galvanic corrosion, eliminating the major source of failure of underground lines. It is highly resistant to salt water and sour crude oil, as well as to most corrosive chemicals.

Piping made of Geon maintains maximum flow efficiency. The interior surfaces are smooth. Frictional head loss is minimized. The build-up of deposits is retarded.

These advantages of Geon piping are easily realized. The piping is lightweight, easy to handle, simple to install. You'll save on time and labor . . . as well as on lifetime cost. For new booklet listing properties of rigid Geon write Dept. FO-5, B. F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ont.

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B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

Southern's light weight, high strength steel pipe offers *real savings*. The longer the line, the greater the economies. You save in ease of handling, require fewer joints, fewer loads and lighter field equipment. Installation costs are substantially reduced because of longer lengths. In addition to *all* these advantages, Southern's revolutionary high frequency, resistance welded steel pipe has no interior or exterior bead—assuring holiday-free coatings whether field or mill-applied.

Available in a wide selection of thicknesses, diameters, and lengths. Get the full story on Southern's welded steel pipe—write, wire or call

No weld beads!

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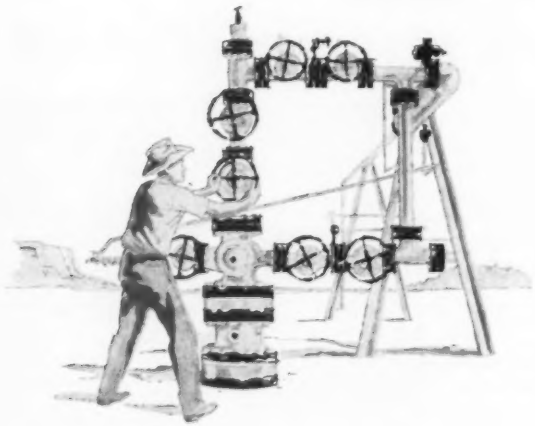
ENERGY
makes the WEST GROW

The all-round growth of the nine Western States served by El Paso Natural Gas Company and its subsidiaries continues to accelerate, consuming energy at an unprecedented rate.

New growth calls for new energy—energy to make arid lands fertile . . . energy to make rigorous climates pleasant with air-conditioned homes and offices for year-round living and working comfort . . . energy to increase production in plants, in mines, in fields.

Since 1928, when El Paso Natural Gas Company was formed, population in these nine states has almost *doubled.* Looking ahead, this new West sees its present population increasing by almost 30% in the next 10 years.



To help keep the West supplied with the energy required for future growth, El Paso Natural Gas Company is engaged in continuing and intensive programs to augment its large reserves of natural gas. In the past 10 years despite the tremendous increase in sales to El Paso's market, our committed reserves have increased over 100%. The rapid rise of these reserves is equalled only by the unparalleled upsurge in Western energy requirements.

Intensive exploration for, and acquisition of, natural gas reserves are just two of many El Paso activities designed to help serve the energy needs of the West.

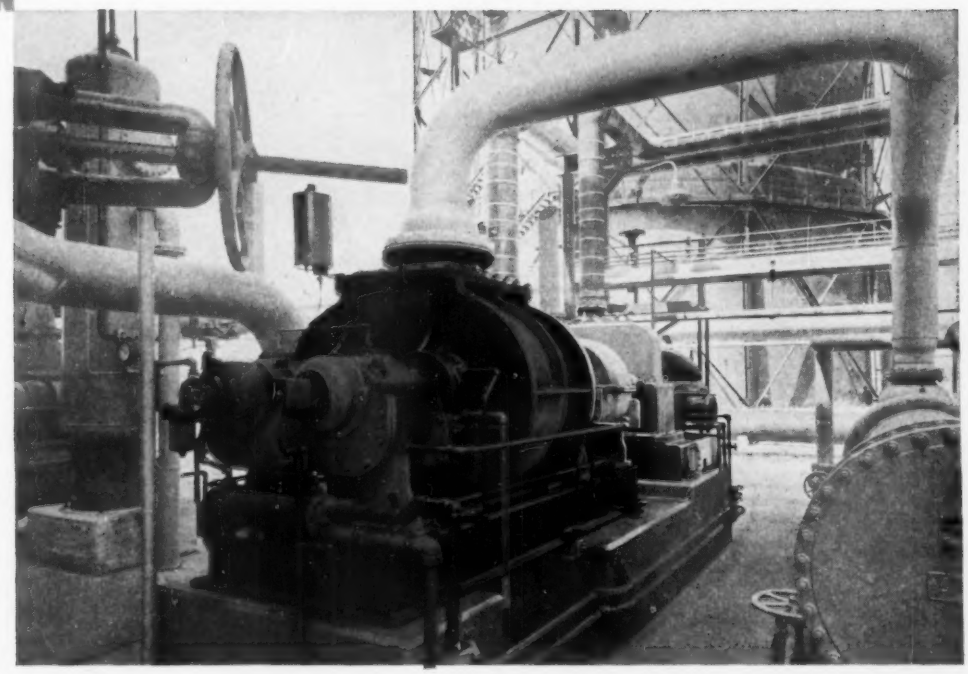
El Paso and its subsidiaries operate a network of natural gas pipelines, the world's most efficient means of transportation. Other activities are conducted in exploration for and supply of petroleum, in refining, in the marketing of petroleum products, in the manufacture of petrochemicals—and in the search for and processing of uranium, a fuel of tomorrow.

El Paso Natural Gas Company and its subsidiaries serve California, West Texas, Arizona, Idaho, Nevada, New Mexico, Oregon, Utah and Washington.

EL PASO NATURAL GAS COMPANY

MATHIESON

For Olin Mathieson



R-C pumps and blowers control air and gas mixing

In the manufacture of ammonia at this large Olin Mathieson chemical plant at Lake Charles, Louisiana, large volumes of hydrogen, nitrogen and air are positively proportioned and compressed by Roots-Connersville equipment.

R-C Gas Pumps are teamed with Rotary Positive Blowers to handle pure hydrogen gas and air for processing into a 3:1 hydrogen-nitrogen synthesis. Another R-C Gas Pump compresses this mixture to supercharge other equipment.

Inherently high efficiency of the famous R-C rotary positive design, extremely low friction loss and extra deep stuffing boxes are a few of the reasons why this equipment delivers maximum performance within rated capacities.

Here is another example of the widespread application of R-C equipment in the process industries. If you have a product or a process requiring handling and accurate control of air or gas, Roots-Connersville engineers will welcome the opportunity to give you the benefit of their long experience. Address your inquiry to Product Development Manager.

R-C Rotary Positive Equipment purchased for this installation

22 x 29 Gas Pump rated 4975 cfm, 514 rpm, 425 Hp

14 x 28 Gas Pump rated 4250 cfm, 830 rpm, 112 Hp

10 x 18½ Blower rated 1770 cfm, 830 rpm, 37.6 Hp

The 14 x 28 Gas Pump and 10 x 18½ Blower are direct-driven in a single assembly.

The 22 x 29 Gas Pump functions as a supercharger for the 3:1 hydrogen in nitrogen gas mixture.

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.

1057 Oregon Ave., Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto, Ont.

Engineers—unusual career opportunities await you at Roots-Connersville. Address your resume to Professional Employment Manager.

Bigger cargo area!

Another new and bigger Forward Control 'Jeep' Truck—the FC-170—puts a big 9-foot platform stake body on a wheelbase only 103½-inches long. This 7,000-pound GVW workhorse has room for 49 bales of hay, 35 bags of cement, or 60 bushel baskets. And the bed is only 35-inches from the ground for back-saving ease of loading!

"Go-anywhere" action!

The new 'Jeep' FC-170 Truck sets a new standard for "big-load" maneuverability. It delivers payloads of up to 3500-pounds to areas ordinary vehicles can't reach. The spacious Safety-View cab puts you in a "Forward Control" position—lets you maneuver on or off the road with greater command of any driving situation!

Tough-job traction!

The extra traction of FC-170 4-wheel drive, and its wide 63-inch tread, take you "almost anywhere" with ground-gripping stability. It shifts easily into conventional 2-wheel drive for highway travel. The high-torque Hurricane 6-226 engine delivers real working power at low cost. It's ready for your bigger, tougher jobs!

New 'Jeep' 4-Wheel-Drive Forward Control FC-170

Willys...world's largest manufacturers of 4-Wheel-Drive vehicles

...other members of the famous 'Jeep' family:

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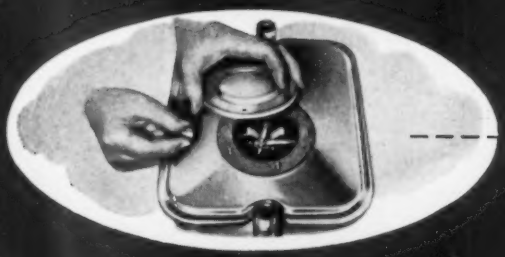
See 'Jeep' vehicles at your Willys dealer

New Advanced Design AMERICAN® "W" series Steelcase Meters



rdcase meter
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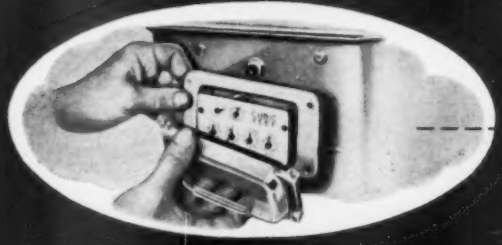
sily opened handhole.



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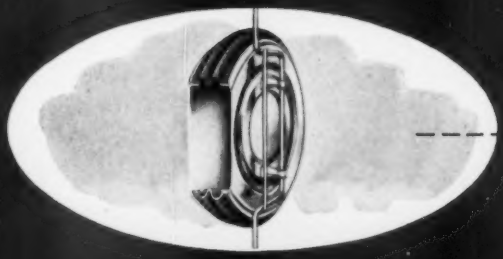

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phragms and
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ovide trouble-free
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re meter life.

- ★ **Light Weight, Welded Steelcase Construction**
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- ★ **Long Service Life at Lowest Maintenance Cost**
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And every American meter refinement developed in 120 years of meter engineering.

MODEL W-175

The unusual advantages of this new series by American open entirely new possibilities in meter maintenance and retirement.

W-75 Rated Capacity 75cfh FOB Philadelphia, W-45-LPG Rated Capacity 45*cfh FOB Philadelphia, W-175 Rated Capacity 175cfh FOB Fullerton Calif., W-210 Rated Capacity 210cfh FOB Philadelphia, W-250 Rated Capacity 250cfh FOB Philadelphia, W-300 Rated Capacity 300cfh FOB Philadelphia

*Propane.

Rated capacities based on 0.64 sp. gr. gas at ½-inch pressure drop—5 psi working pressure.

Consult your American Meter representative for full information.

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NEW! Superior

. . . the slow-motion meter you can rely on longer

Designed from scratch to take advantage of all the time-tested advances in meter technology . . . built in Superior's new plant to exploit all the latest meter design and manufacturing techniques . . . operating at only 7 revolutions per cubic foot to reduce wear and stay accurate longer . . . that's the story of the new Superior aluminum case meter.

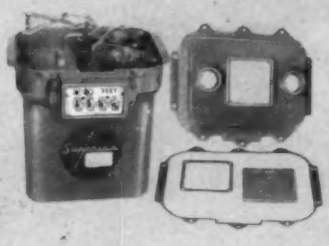
And, when you *do* have to check it, meter maintenance is quick and simple. Whether it's adjusting the tangents through the handy access in the top . . . removing the top to grind the valve seats . . . or lifting out the valve table with the entire inner movement to replace the diaphragm, simply loosening a few screws makes everything accessible. Get full details on this modern meter today. Send for bulletin 1150.

SUPERIOR METER COMPANY, INC.
19 West 50th Street, New York 20, N. Y.
A SUBSIDIARY OF NEPTUNE METER COMPANY

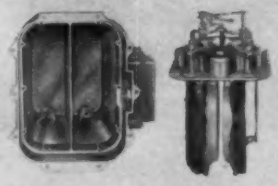
neptune

Look at these advanced design features:

1. Simple, horizontal seam . . . eliminates leakage . . . easier maintenance
2. Easily accessible table . . . just remove the screws holding top



3. Valve seat readily accessible for grinding when top is removed
4. Meter top removable without taking off index box
5. Valve table lifts out with entire mechanism



6. Slow movement; only 7 revolutions per cubic foot
7. Cupped handling lids permit easy and safe carrying

ALUMINUM CASE METERS

In 250 cfh and 340 cfh sizes to meet most domestic requirements.

8. Broad base for solid stacking ...designed for conveyorized handling

9. Accurately controlled diaphragms... no inaccuracies from deflection

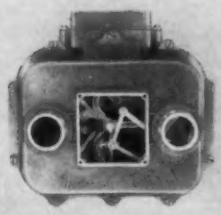
10. Seam gasket stays resilient ...cork and Buna-N composition

11. Heavy-duty, sintered bronze bearings oil-impregnated for life

12. Index removable without removing meter

13. Flag arrangement gives arm smoother operation and longer life

14. Handy access for tangent adjustment and calibration



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A background of over 70 years in gas industry design and construction.

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Due to continuing research in the development of thermal and catalytic apparatus and processes for gas production.

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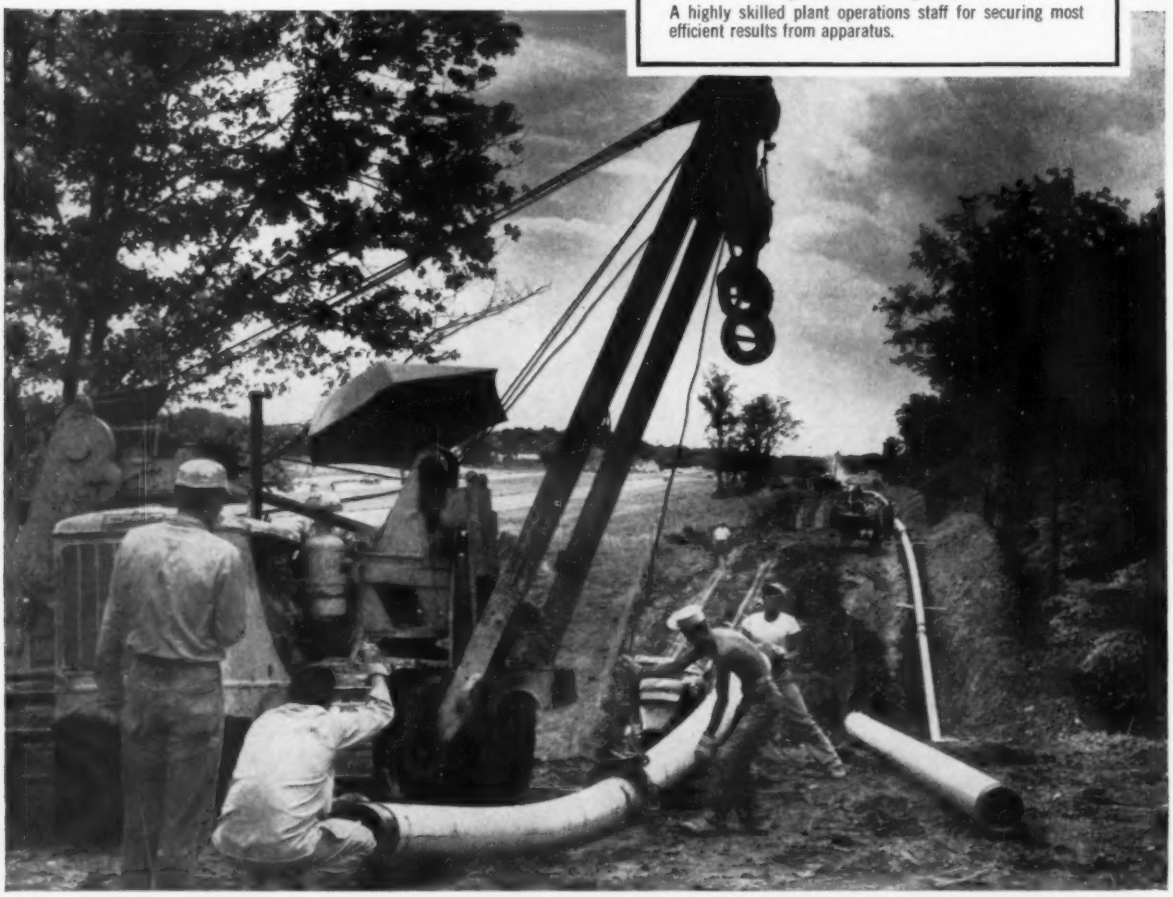
A large, well-organized force for natural and manufactured gas construction work.

Experience in Operation

A highly skilled plant operations staff for securing most efficient results from apparatus.



The new Kingston to Albany pipeline of the Central Hudson Gas and Electric Corporation conquers the many challenges presented by 46 miles of rugged terrain, snaking its way over mountains and even scaling a 300 ft. cliff. Construction supervision and inspection services were supplied by United Engineers.

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Our list of clients includes many of the nation's forward-thinking industries and utilities

"A challenge to all of us". . .

a statement by ***Robert B. Anderson,*** *Secretary of the Treasury:*

"The ownership by 40 million citizens of over 41 billion dollars in Series E and H Savings Bonds is a striking testimonial of confidence in America's bright future. It means security and opportunity for millions of families —a way to provide for children's education, the building of new homes, or more comfortable retirement.

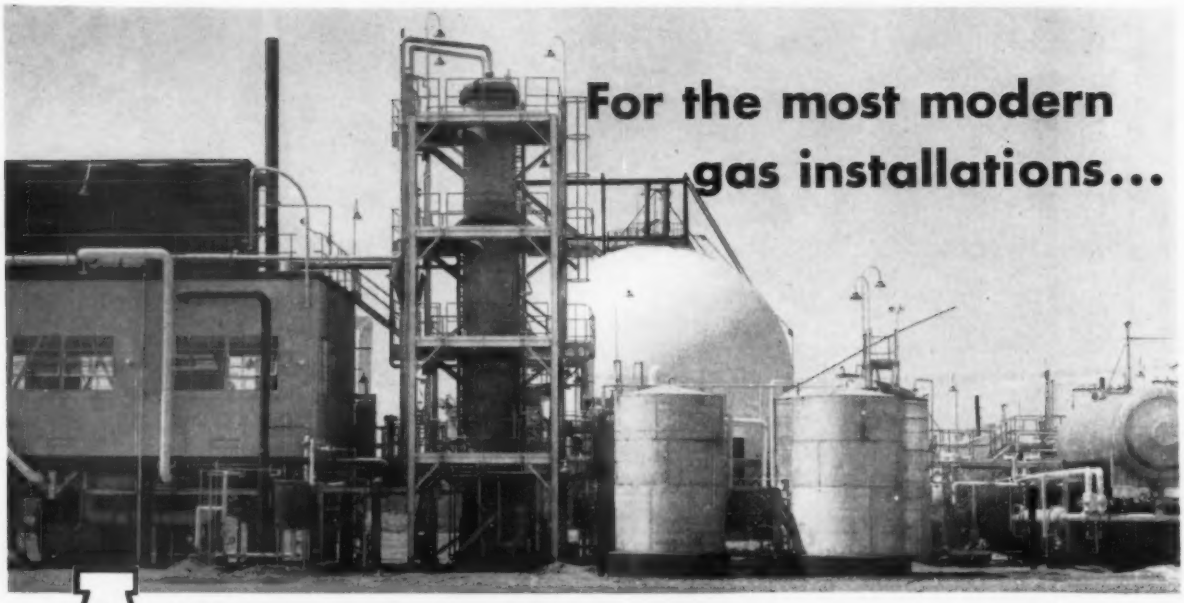
"America benefits, too, from such widespread savings bonds ownership. This partnership of individual citizens in their government's fiscal operations means better management of the public debt—greater stability for our money—brighter prospects for the years ahead.

"Our country *needs* more savings—in all forms, including U.S. Savings Bonds—to help finance our growing economy; to pay for the plants and tools that mean more and better jobs for our ever-increasing population.

"Meeting this need is a challenge to all of us. Americans everywhere should be encouraged to regularly put aside part of their earnings for future needs. And certainly part of that saving belongs in the now better-than-ever U.S. Savings Bonds."

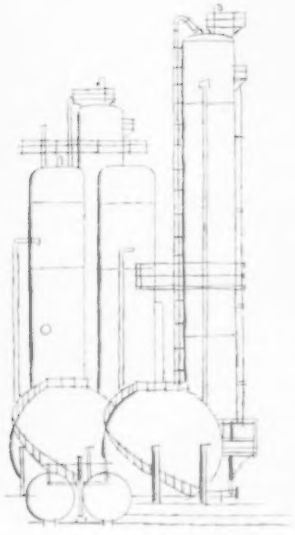
The United States Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

GAS MAGAZINE



For the most modern gas installations...

AMERICAN CAST IRON PIPE



Ammonia is now being produced from coke-oven gas at the first plant of its kind in the United States, the Ketona plant of the Alabama By-Products Corporation.

The principal gas supply line for this plant is American Cast Iron Pipe. Here, as in hundreds of other gas transmission and distribution installations, the rugged dependability and time-proved long-term economy of cast iron pipe were reasons for its selection.

American Cast Iron Pipe, manufactured with the original standardized mechanical joint designed specifically for gas service, will serve your piping requirements better . . . longer . . . at lower annual cost. Call the American Cast Iron Pipe Company representative nearest you for detailed information and technical assistance when you're planning your next installation. You will find his factual information, wide experience and recommendations valuable.

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Obviously, you are not going to install these new filters without first testing them yourself. That's why we'd like you to accept our offer to give you a Staynew Home Gas Filter FREE, and without obligation. You can test it anyway you like, and see for yourself its many advantages. All we ask is that you write us on your company letterhead so we are sure that the filter goes only to authorized personnel. Address: Dollinger Corporation, 68 Centre Park, Rochester 3, N. Y.

STAYNEW MODEL CPHB HOME GAS FILTER

Here's the most economical way to remove dirt, pipe scale, and other foreign matter from natural gas lines, and keep your customer's appliances operating efficiently.

Thousands are already in use helping to keep service calls to a minimum by stopping dirt—the major source of clogged pilots.

Installation: Upstream from meter on low-pressure systems; downstream from meter in front of regulator on high-pressure systems.

Sizes: ¾" and 1" female threaded inlet and outlet. Other sizes available on request.

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Want More Data? **Mail the coupon for complete information on Dollinger Gas Filters. Write on company letterhead for free trial filter.**

DOLLINGER CORPORATION, Rochester 3, N.Y.

PLEASE CHECK:

- ☐ **Staynew Gas Filter Bulletin 290-R**
- ☐ **More information on new Home Gas Filter Model CPHB (Note: for free filter, please write on company letterhead)**
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- ☐ **I have a specific filtration problem. Watch for my letter.**

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Modern method of service replacement

There's no trenching with tubing of Tenite Butyrate

Plastic tubing of Tenite Butyrate is the fast, economical way to replace corroded metal services. Trenching is eliminated. You merely dig two holes: one at the gas main tap, the other at the service riser. Tubing of Tenite Butyrate is then run right through the old pipe. Since its smooth walls create less friction than metal tubing, pressure is unaffected by the resulting slight decrease in diameter.

Tubing made of Tenite Butyrate has other advantages too: It is amazingly light in weight; an average service of 70 feet weighs less than four pounds. Connections are made between tubing and metal pipe

1932—EASTMAN'S 25TH YEAR IN PLASTICS—1957

with simple adaptors. What's more, the tubing is unaffected by corrosive or electrolytic action of soil—your assurance of many years of trouble-free service.

Over a decade of use has proved the many advantages of Butyrate over metal for natural gas service. Nearly three million feet of this plastic tubing have already been installed by one company alone. *Tenite Butyrate has also been used by several progressive utilities as a material for mains.* Find out more about this modern approach to natural gas distribution. For information about tubing made of Tenite Butyrate, its fittings and installation, plus the names of suppliers near you, write: EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

A 16mm. sound-color film, "Plastic Pipelines," is available upon request.

TENITE
BUTYRATE
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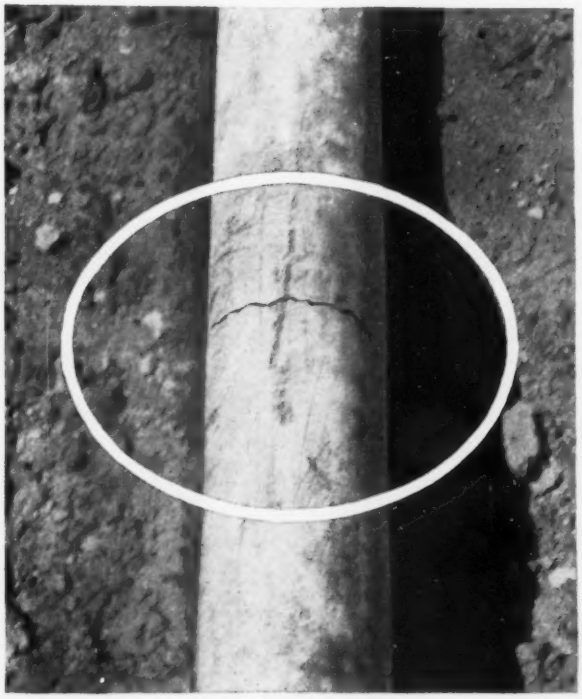
in 10 minutes...

PIPE BREAK TO PERMANENT REPAIR



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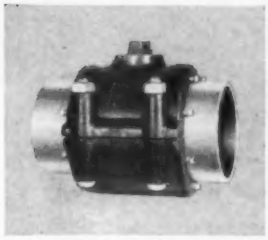
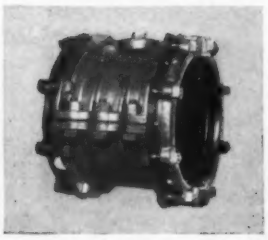
FOR WINTER BREAKS!



Style 80—Ready-Pack Sleeve. Light weight, low cost. Insures gastight repairs, even on off-size pipe. Completely encloses the break. Fast, one-man repair on cast iron pipe from 3″ to 8″ diameter.



Style 57C—Cast Split Sleeve for longer breaks or splits in straight run of pipe. Quickly installed on cast iron pipe 2″ to 12″ diameter. Two or more sleeves can be joined to cover pipe breaks longer than 8″.

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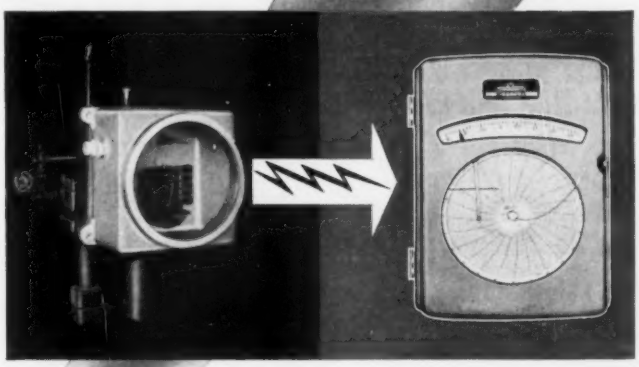

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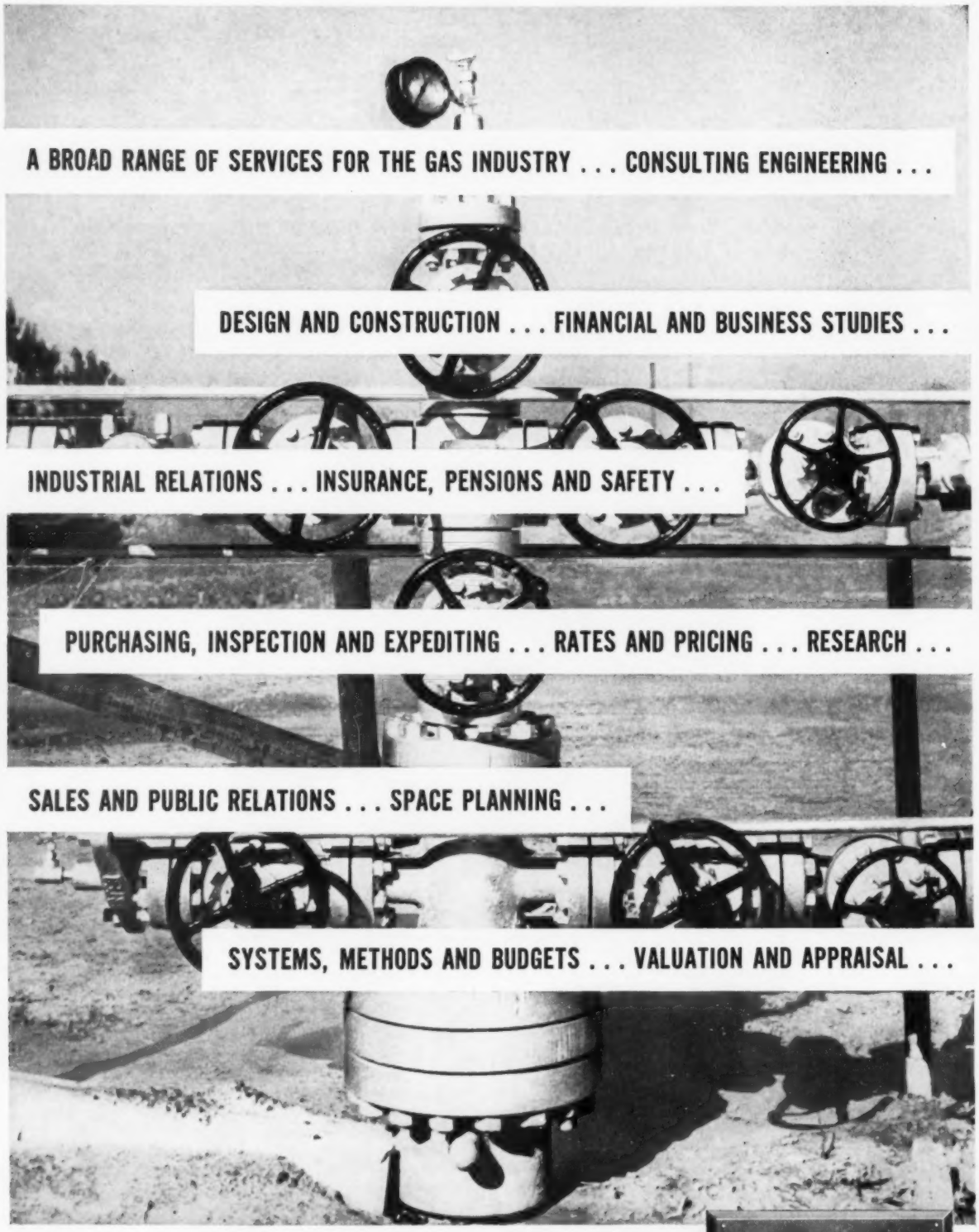
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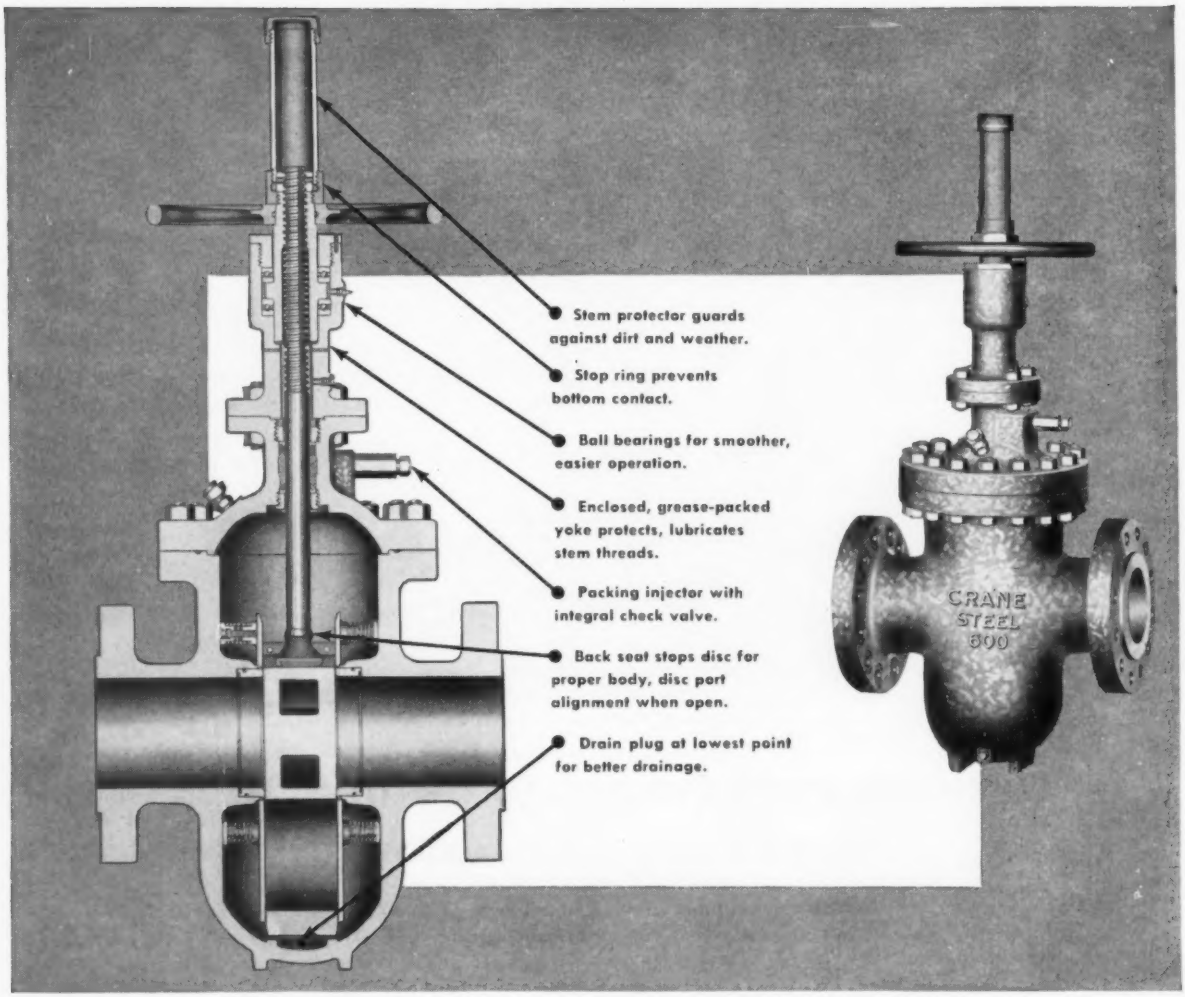
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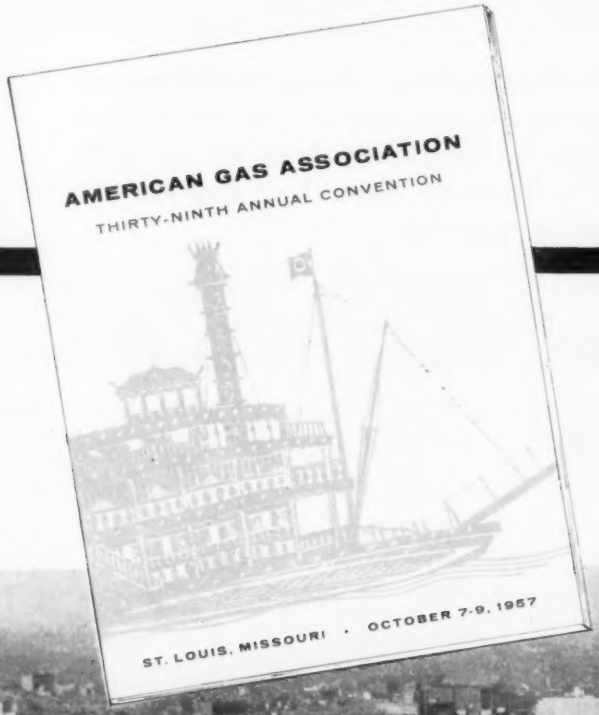
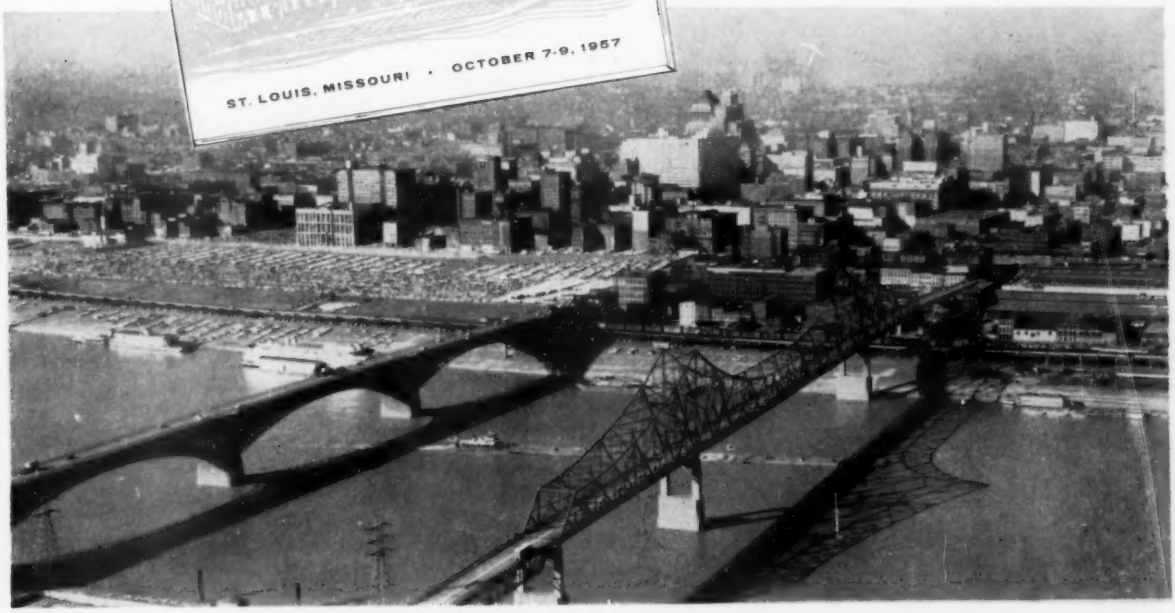
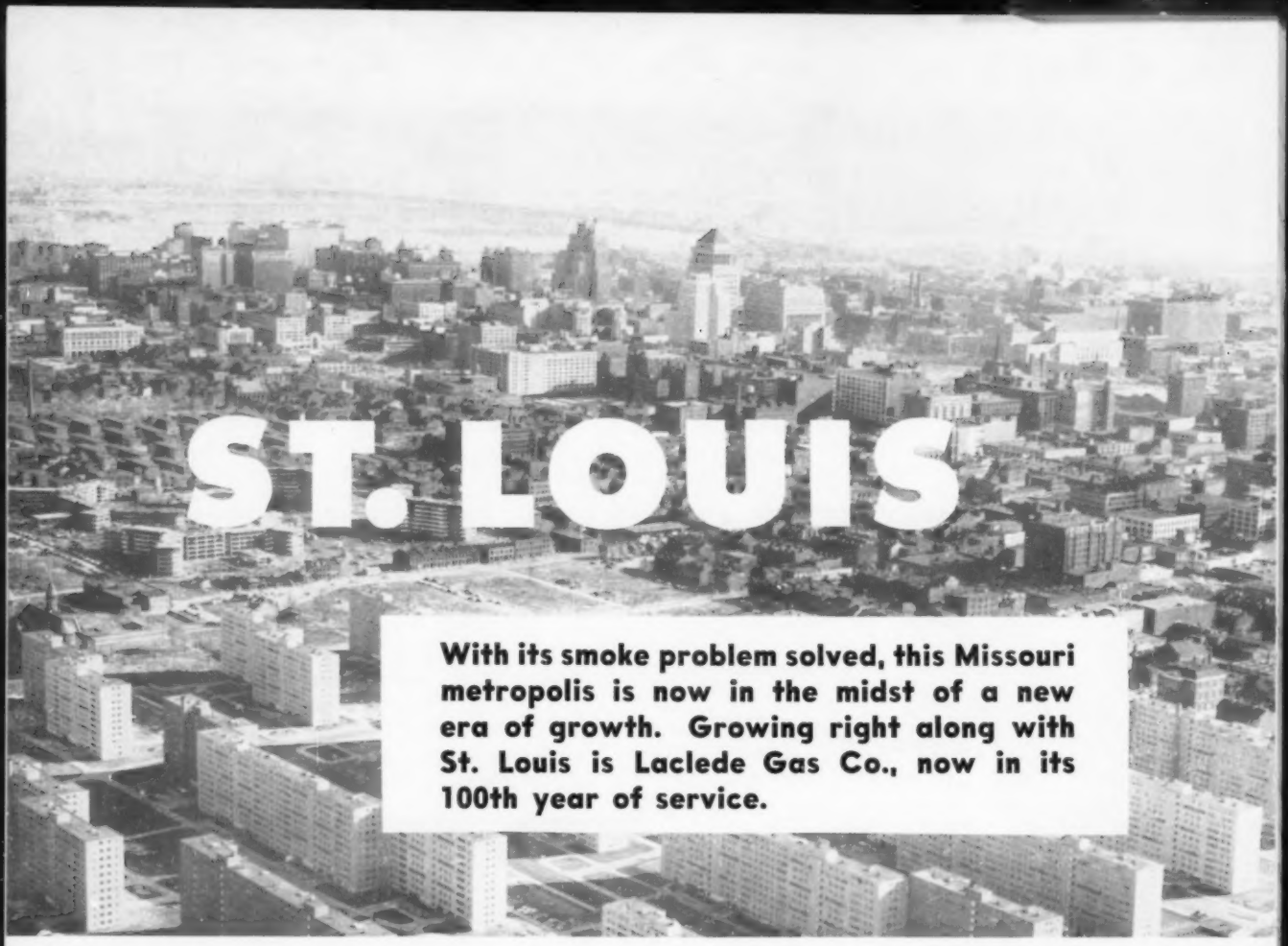


St. Louis—Home of Laclede Gas Co.—*See page 66*

St. Louis—Host to the AGA Convention—*See page 85*





ST. LOUIS

With its smoke problem solved, this Missouri metropolis is now in the midst of a new era of growth. Growing right along with St. Louis is Laclede Gas Co., now in its 100th year of service.

By DON WRIGHT • Managing Editor

ST. LOUIS is the nation's eighth ranking city with a population of 865,000. Within the metropolitan environs 1.9 million people live and work. It is easily one of the United States' leading industrial and economic centers—and it has been growing at a phenomenal rates since World War II.

But St. Louis has not always been a growing, bustling industrial area. During the 1930s, it was stagnant. Its population dropped from 821,960 in 1930 to 816,048 in 1940. Granted, this was during the decade of the depression, but the depression alone didn't cause this exodus.

St. Louis had a problem—a problem of air pollution that now is plaguing many major U. S. cities. But, unlike many of these cities (especially Los Angeles), St. Louis recognized its problem, then went out and solved it.

Smoke first was a problem in the 1880s. It became progressively more acute in the ensuing years. By the mid 1930s, the citizenry had had enough. A white shirt was filthy before noon, freshly laundered curtains were soot filled in a matter of hours, and on many days, you couldn't see across the city's spacious 12th St. in the downtown business district.

Residents of St. Louis were faced with two choices: (1) move somewhere else, or (2) buckle down and do something to eliminate the smoke. A few chose the first, but, fortunately, a great majority of residents liked it there, and wanted to clean up the skies. This latter group began work in earnest when several industrial firms packed up their equipment and moved to cities with clear skies.

In 1936, a citizens' committee got the city's smoke abatement program rolling. It has been the efforts of this group that has caused the "New Spirit of St. Louis" to really take hold and move the city ahead once again.

When the disgusted citizens went into action, they didn't fool around. Whenever a thorough change must be made in a city's living customs, some toes are bound to be stepped on. St. Louis not only stepped on some toes, they stomped—hard.

The biggest contributor to the smoke-filled skies were domestic coal-burning furnaces. Industry, though contributing to the smoke

GAS staff report

problem, was not a major contributor to smoke—natural gas had been available to many large industrials since 1929, and to medium and smaller industrial firms since 1932.

The target for the anti-smoke forces was the highly volatile, low grade soft coal mined in the nearby mining regions of Illinois. This coal, when used in old hand-stoked furnaces, emitted a billowing cloud of black smoke. On cold days, when nearly every furnace was in operation, it was next to impossible to tell whether it was night or day.

A strong smoke abatement law was drawn up. Architect of this law was Raymond R. Tucker, now the city's mayor but at that time a professor of mechanical engineering at St. Louis' Washington University. With the backing of then mayor Bernard F. Dickmann, the city council enacted the laws, and saw to it that they were enforced. Mr. Tucker was named the city's first smoke abatement commissioner.

Additional laws regarding fly-ash content of coal were added by the city in 1948.

The result of this anti-smoke campaign was the re-emergence of clear skies over St. Louis—and the re-birth of the city as a thriving industrial community. This industrial re-birth carried over into civic affairs as well.

With the elimination of smoke-clogged skies, St. Louis, in the days since World War II, has been enjoying as rapid an industrial growth as any part of the U. S. In the past five and one-half years, the city's Chamber of Commerce proudly points out, an investment of $1.5 billion has been made to establish new plants and businesses and expand existing ones.

Mayor Tucker recently credited the elimination of smoke for this revitalization of industrial economy.

St. Louis' civic pride, at a low ebb during the smoke days, also has been rekindled. Typical of this new look generated by the "New Spirit of St. Louis" is Lambert Field, the sparkling new airport. Modernistic in every detail, it is by far one of the nation's best air terminals. Last year, citizens passed a monumental $110 million civic improvement bond measure.

St. Louis was founded in 1764 by Pierre La Clede Liquest. He

Broadway and Pine in downtown St. Louis looked like this in 1892. Cable car has just passed under gas-lit archway of presidential portraits, put up for Columbian Exposition.

chose the spot on the Mississippi river, close to the mouth of the Missouri, because it made a good terminal, interchange point and supply base for early trappers, traders and settlers.

When Pierre La Clede Liquest founded the small settlement, he could not possibly have visualized how it would mushroom in less than two centuries. Today, St. Louis is one of the nation's largest railroad terminals (served by 18 trunk lines), it is the leading shoe manufacturing area in the world (numbering among its industrial firms several divisions of the huge International Shoe Corp. and nearly all of the equally large Brown Shoe Corp.).

It is a leading brewery area (Anheuser-Busch got its start in St. Louis, and still has its biggest plant there). McDonnell Aircraft has grown into one of the nation's largest defense industries. Several big steel mills are located on both sides of the Mississippi in metropolitan St. Louis.

And industry there is well diversified. Civic leaders proudly point out that no one manufacturing industry employs more than 6 per cent of the total number employed in manufacturing.

St. Louis was still a young frontier city when the gas industry joined its development. It was the seventh city in the United States to get gas service (the first west of the Mississippi river) when a gas company was organized on Feb. 4, 1837.

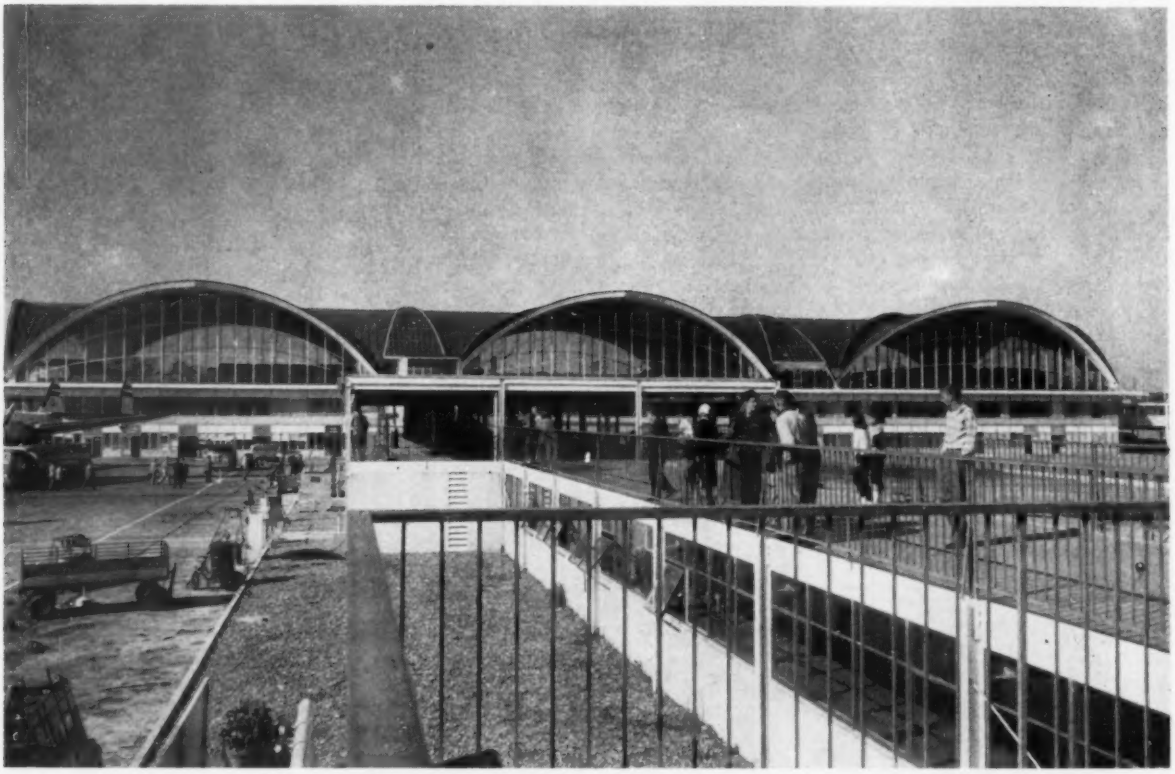
This gas company was formed by a group of local businessmen who had been intrigued by a similar venture in Baltimore. They felt that gas could be used for street lighting and might help cut down the lawlessness on dark streets that was so prevalent during those rough and ready days in the fur trading center.

Gas, however, didn't begin flowing through mains in St. Louis for several years after the founding of the St. Louis Gas Light Co. The first gas-making plant was completed at Second and Convent Sts. (now the site of Laclede Gas Co.'s Station A) in 1841, and initial distribution operations soon followed.

But the people of St. Louis had to wait until 1847 to get their streets lighted with gas. A weekly newspaper of that day glowingly described the eventful lighting of the gas street lights this way:

"The gloom of our streets was dispelled for a portion of last evening (Nov. 6, 1847) by the first burst of gas light. A crowd gathered around every lamp post, as the plume of flame waved in the wind, pleasure shown upon each countenance. It is no longer a dream from which we are to awake in disappointment."

St. Louis Gas Light Co. had no competition for another 10 years. Then, two more gas companies appeared on the scene. The Laclede Gas Light Co. was incorporated on March 2, 1857; a day later the



St. Louis leaders point with justifiable pride to ultra-modern Lambert Field, one of U. S.' newest commercial airports, as an example of the "New Spirit of St. Louis."

Carondelet Gas Co. was founded and franchised. Laclede has survived a century of operation, and today is one of our industry's strongest, and most respected, companies.

Still another gas company entered the scene on May 22, 1880, when the St. Louis Gas, Fuel & Power Co. was formed.

When the Laclede Gas Light Co. was incorporated by a special act of the legislature in 1857, among its privileges was the right to make and vend gas and "any substance, or material that may now or hereafter be used as a substitute therefor." By an act approved March 26, 1868, the franchise of the company was made perpetual and its privileges extended throughout the corporate city limits of St. Louis "as the same are now or may hereafter be established."

There were two big drawbacks to the franchise—(1) it limited Laclede to operations within the city limits of St. Louis for years to come, and (2) the franchise was not exclusive.

The St. Louis Gas Light Co. also had been granted a franchise to operate throughout the city limits, and for a time, in the 1860s and early 1870s, it appeared that the two companies would be laying mains in the same areas and competing with each other for customers in the same block. At least one law suit was filed, but before any legal decision was forthcoming, the two companies reached a compromise known in St. Louis as the Tripartite Agreement. Made in 1873, the agreement defined the territories of each company.

This agreement was in force for several years. The two companies operated without trying to serve the same areas. However, St. Louis Gas Light Co.'s franchise, originally set to expire in 1887, was extended to 1920. It became apparent to both companies that something had to be done to avoid cut-throat competition and unprofitable operations to both.

With the blessing of city officials, Laclede acquired, through a Philadelphia investment concern, control of the St. Louis Gas Light Co. in 1890. St. Louis Gas' distribution system and manufacturing

facilities were consolidated into Laclede's.

Shortly after St. Louis Gas Light Co. was acquired, Laclede also purchased the properties of the St. Louis Fuel & Power Co. Carondelet Gas Co., the last remaining competitor, was acquired by Laclede shortly before the former's franchise expired in 1907.

During the consolidation of Laclede and St. Louis Gas Light Co., controlling interest of the Laclede properties was acquired by H. B. Hollins & Co., Philadelphia investment brokers. They retained the company until 1903, when controlling interest was purchased by North American Co.

North American held on to Laclede for only six years, then sold its interests to a group of St. Louis men represented by G. H. Walker & Co. In turn, this local group sold out to out-of-town control in April 1924, when C. A. Munroe & Associates, Chicago, took over. In 1927, the Munroe organization sold control of Laclede to Harley L. Clarke's Utilities Power & Light Corp., a Chicago utilities holding company.

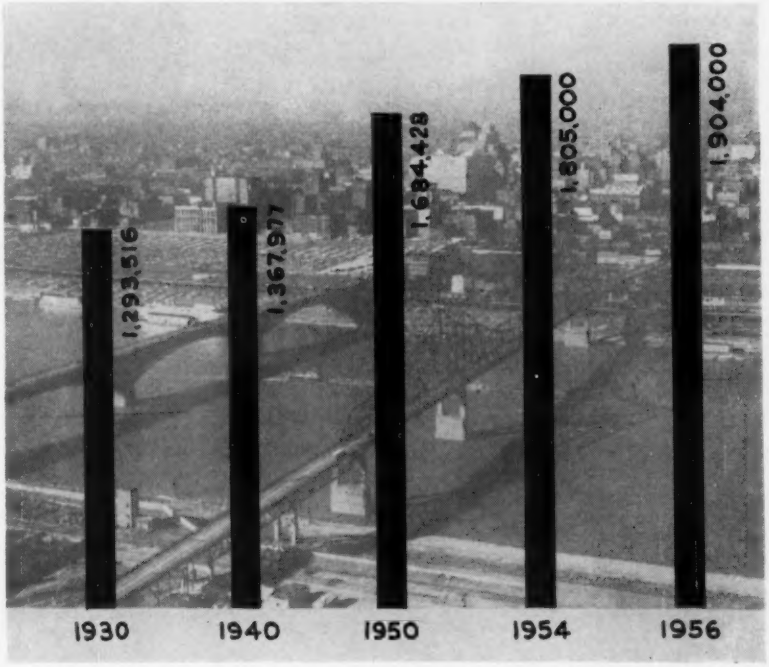
The Clarke organization owned and operated Laclede from 1928 to 1937. During the final years, the Laclede Gas Light Co. was in precarious financial straits.

In 1937, though, the Atlas Corp. of New York bought out the Clarke holdings, and took immediate steps to put Laclede back on its feet.

The first move was to put the company back in managerial hands of St. Louis people. Four local civic leaders—L. Wade Childress, William D'Arcy, E. E. Pershall and A. Wessell Shapleigh—were named to the board of directors. The next year Mr. Childress was elected president of Laclede.

On Aug. 1, 1941, Mr. Childress

Chart shows the population growth of metropolitan St. Louis.



announced a comprehensive reorganization and simplification plan for the company's financial structure. Included in the revamping was the announced plan to dispose of the company's electrical properties acquired in earlier years. These properties were finally sold to Union Electric Co. (St. Louis) in 1945. The reorganization put Laclede back on its feet and ready to go stronger than ever.

Laclede's original franchise limiting its operations to the corporate city limits of St. Louis, was virtually killing any expansion plans. It was bounded by St. Louis county on three sides, and the muddy waters of the Mississippi river on the fourth.

Even more binding was the fact that the city of St. Louis had broken away from St. Louis county in 1876 in a disagreement over apportionment of taxes and became a separate governmental district in the state of Missouri. This break in effect eliminated any possibility of the city's borders expanding through annexation. Under Missouri law, annexation is possible only with a majority vote from all voters in all or both areas affected —and this was not about to happen.

While Laclede was effectively stymied from any great expansion, the St. Louis County Gas Co., owned by North American Co., was growing at a fast clip serving the cities and communities in St. Louis county.

The St. Louis County Gas Co. had started in 1904. For its first six years of operation, it purchased manufactured gas from Laclede. Then, in 1910 it built its own gas manufacturing plant and became self-sufficient.

Laclede's management had been eyeing the County Gas Co. for several years. In 1947, an agreement finally was reached with the North American Co., and on Feb. 28, St. Louis County Gas Co. was purchased by Laclede. This gave Laclede the room to expand, and it has been doing just that ever since.

Shortly after the acquisition of the County Gas Co., Mr. Childress resigned as president and moved up to chairman of the board. Robert W. Otto, a director and general counsel who had been affiliated with Laclede since 1932, was elected president.

Judge Otto served as president of Laclede until early 1956, when he was named chairman of the board. He was succeeded in the presidency by H. Reid Derrick, a veteran gas official who came to Laclede from the presidency of the Alabama Gas Corp. (Birmingham).

In 1950, the company's name was modernized, dropping the word "Light," and making it the Laclede Gas Company.

ROBERT W. OTTO

H. REID DERRICK

Gas lights were a big load factor for Laclede for many years. In 1913, these gas lights were put into use replacing electric lights. Building is located at intersection of Gerardes, Maryland and Kingshighway.

From gas lights to full diversification of load

ANY company that has been doing business—successfully—for more than a century has had to revise its sales objectives many times along the way. The Laclede Gas Co. is no exception.

One of the biggest markets for Laclede and its predecessor was the lighting load. City street lights were lighted with gas; commercial and industrial buildings used lots of gas for lighting, and residential users were good customers too.

Then in 1887, Thomas Edison perfected the electric light and the gas industry throughout the U. S. had to look to other loads. Before the Edison development some 90 per cent of Laclede's load was lighting. Fortunately for Laclede, the people of St. Louis regarded the electric light with a conservative air when it first appeared.

Gas lights still burned brightly on St. Louis streets until well after the turn of the century. It was not until the mid 1920s that the final gas lights were replaced on many of the city's main thoroughfares.

Laclede's officials saw that the gas range would be the answer to the industry's quest for new markets. The gas company began working with a major range manufacturer in St. Louis (the Ringer Stove Company, now Magic Chef Inc., which has just recently moved to a new location in Tennessee), and began promoting "Quick Meal" gas cooking.

Because of these initial efforts scores of years ago, St. Louis today is one of the nation's best gas range markets.

During the middle of the roaring 20s, Laclede began taking an active part in St. Louis' initial efforts to combat the smoke problem. The company did much to arouse the public to the dangers of the smoke blanket with a billboard campaign pointing out the smokeless advantages of gas heating.

Laclede intensified its house-heating campaign in 1932, when mixed gas (800 Btu) was introduced. With this mixed gas came a special low rate for househeating.

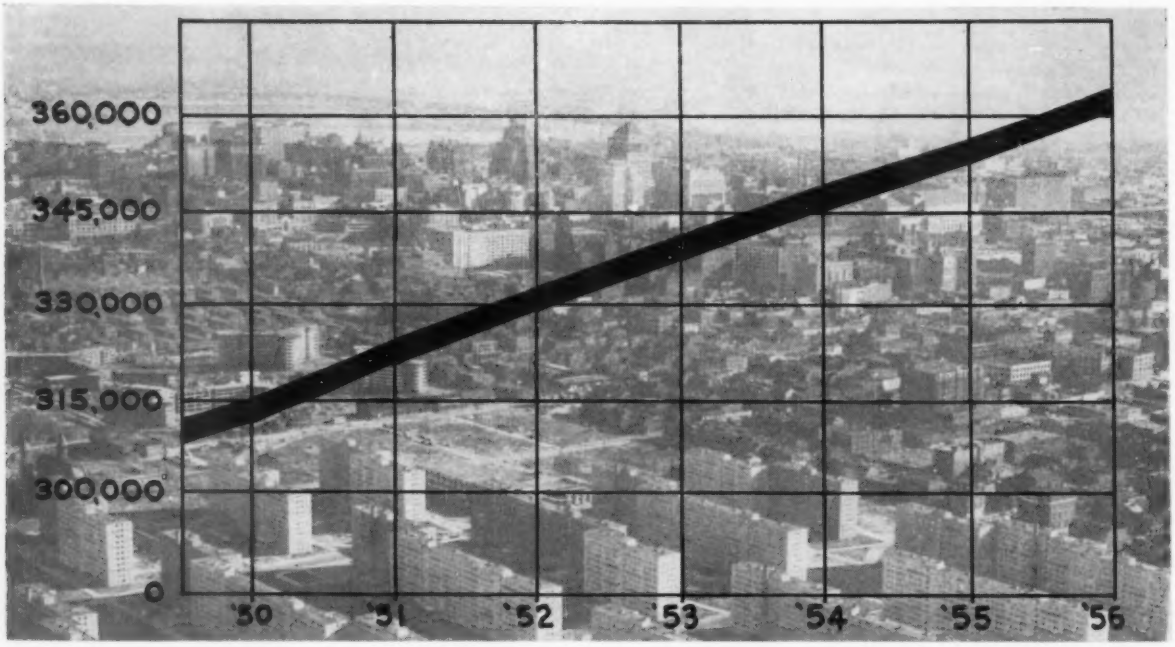


Fig. 1. CUSTOMERS (End of Year):	1950	1951	1952	1953	1954	1955	1956
Residential	299,525	309,357	317,565	323,406	330,709	337,098	344,336
Commercial & Industrial	15,889	16,470	16,400	18,545	18,770	18,968	19,544
Interruptible	3	5	20	52	96	131	155
Total Customers	315,417	325,832	333,985	342,003	349,575	356,197	364,035

The adoption a few years later of a smoke law which helped to eliminate cheap grades of highly volatile soft coal made gas competitive with all other fuels.

But at the time the company started its househeating campaign, gas was in direct competition with cheap coal. To get its campaign really going, the gas company created a staff of 25 househeating specialists, established a special space heating sales campaign, and instituted an aggressive advertising program.

Then, Laclede offered many inducements to the potential gas househeating customer. They offered to clean furnaces, rent the home owner a conversion burner, install a conversion burner free, and even, in some cases, rehabilitate basements to take a gas furnace.

This campaign had already begun to blossom out when the smoke control laws came into being, outlawing the cheap grades of southern Illinois coal. Somewhat later, househeating business really began to go. The demands for this service have become so great that today restrictions have been placed on new househeating customers. More than 35,000 back orders are waiting to be placed on service.

Laclede first recognized the great diversity of St. Louis industry in 1925 and organized an industrial gas department. It was among the first U. S. gas companies to see the potential use of gas as an important industrial fuel.

Laclede trained a group of specialists in developing gas burners for precision burning. These men worked closely with St. Louis industrial firms. The results were outstanding.

The gas company strengthened its distribution system to make industrial take points directly available from a belt line close to the industrial areas. At first, industrial customers were served with 600 Btu manufactured gas.

In 1932, Laclede began buying natural gas from Mississippi River Fuel Corp. That same year, Missouri Industrial Gas Co. was formed by Utilities Power & Light Corp. and was an affiliate of Laclede. This company distributed straight natural gas (through a special system) in the St. Louis industrial district. Thus, industrial customers in some parts of the city have been using natural gas for more than 25 years.

Industrial firms not served by the Missouri Industrial line still were able to get a high heat content gas. Laclede was sending out an 800 Btu mixed gas after the connection to Mississippi River Fuel's line was made. In 1934, the Missouri Industrial system was purchased by Laclede, and Laclede continued to operate the straight natural industrial system until the company's entire distribution system was converted to straight natural in 1949.

By July 1957, Laclede had more than 370,000 customers throughout the service area. The biggest of these, 349,000, are residential customers (cooking, waterheating,

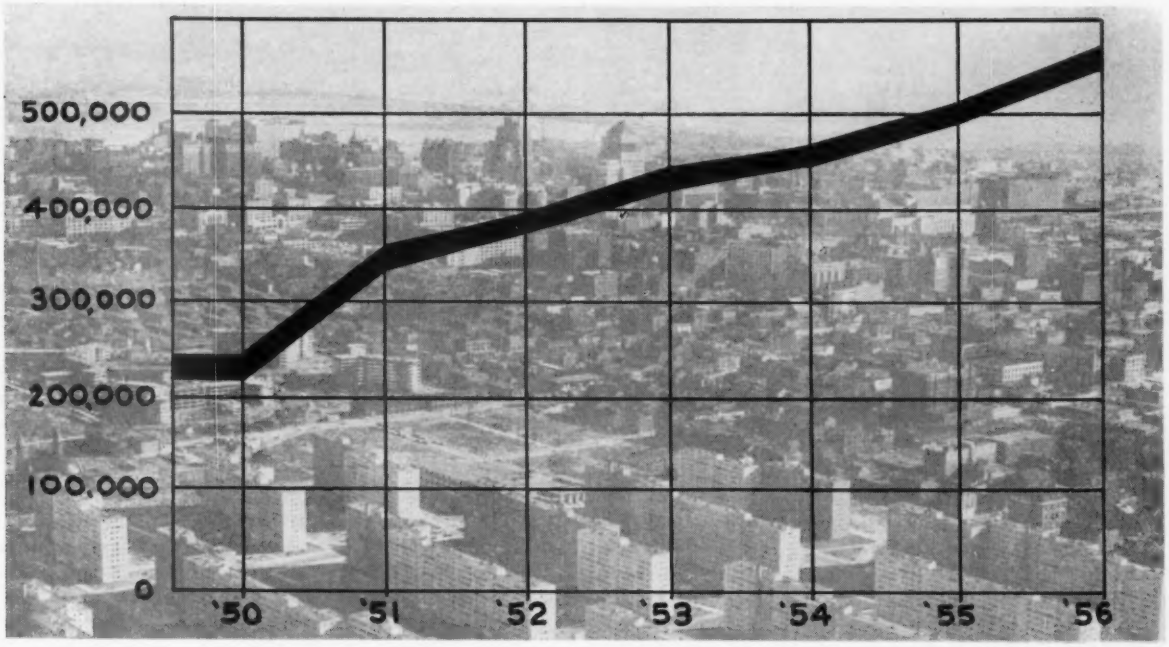


FIG. 2. SALES (Thousands of Therms):

	1950	1951	1952	1953	1954	1955	1956
Residential	157,619	235,986	240,102	248,776	257,877	284,961	327,105
Commercial & Industrial	88,288	122,685	139,733	158,165	154,892	159,027	162,616
Interruptible	1,399	2,164	14,712	38,833	52,472	67,650	87,857
Other Sales	−4,766	—	—	—	—	—	—
Total Sales	242,540	360,835	394,547	445,774	465,241	511,638	577,578

refrigeration, etc.), and an additional 165,000 are heating their homes with gas.

The company serves 18,300 commercial customers and 2100 firm industrial customers. Another 180 commercial and industrial customers are served on an interruptible basis (see *Fig. 1*).

These customers last year bought 577,578,000 therms of natural gas from Laclede. *Fig. 2* shows the startling rise in gas sales since the introduction of natural gas to St. Louis in 1949.

For several years, Laclede has been forced to place restrictions on new househeating customers. Now, it is adding all new construction to the growing list of househeating customers served, and, for each new home added, at least one existing residence is also connected. Before the start of this year's heating season, the company expects to add 14,500 new househeating customers. Still, the backlog of unfilled orders will total several thousand.

Laclede has instituted a unique program of interruptible residential househeating supply, by necessity rather than choice. These customers must install a dual-fuel househeating system. A thermostat is installed which automatically cuts off the gas supply when the temperature drops to a certain level (last year it was 25°F) and the customer must switch to another fuel, usually LPG or fuel oil. On the smaller dual fuel units, the thermostat automatically shuts off the gas and switches to the alternate fuel. The larger ones must be converted manually, after the thermostat sets off a signal device and cuts off the gas. When the temperature rises above the cutoff figure, gas service comes back on.

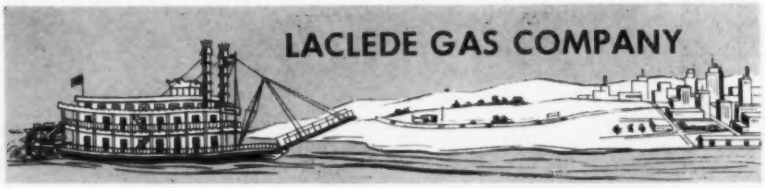
In this way, the interruptible househeating customer can use gas about 80 per cent of the time. Naturally, Laclede is looking forward to the day that these interruptibles can be eliminated, and restrictions on new services taken off.

Industrial sales are a very important part of the company's revenue. Now, its industrial department can take on industrial space heating customers on a dual fuel, interruptible basis. This restriction has been in effect since 1950. This year, the company has been able to slightly relax its restrictions on gas for industrial processing. A limited number of firm customers have been added.

The huge Anheuser-Busch brewery is Laclede's biggest industrial customer. The big brewery boiler room annually uses two billion cu ft of gas, on both a firm and interruptible basis.

Laclede hasn't neglected the residential appliance load. Today, 47.3 per cent of the homes and multiple unit dwellings in metropolitan St. Louis are heated with gas—and the company visualizes an 80 per cent saturation before too many years.

Last year 30,000 new gas ranges, 32,000 new water heaters, 10,000 gas clothes dryers, and 800 gas incinerators were sold in the company's service territory.



Sendout has run gamut from coal gas to natural

THE sendout gas that has flowed through Laclede's mains has run the gamut from coal gas to straight natural.

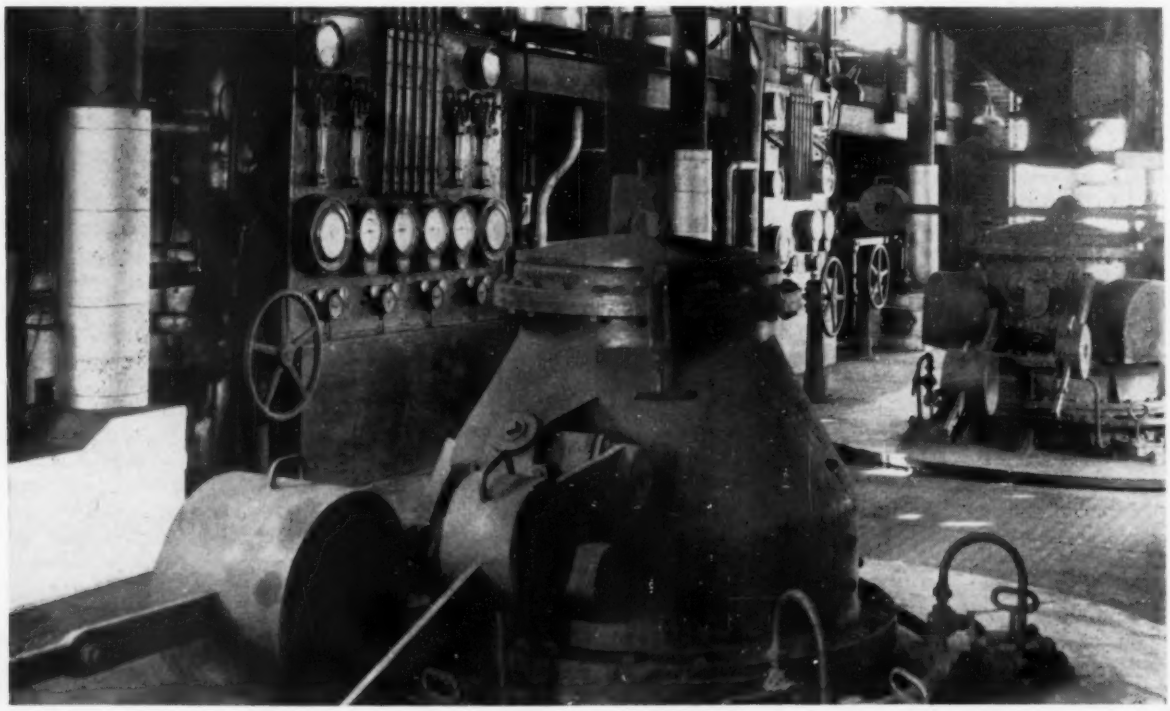
Prior to 1915, the gas supplied to St. Louis customers was coal gas and carburetted water gas. The coal gas was produced in D-type retorts, with a by-product of domestic coke. The water gas was produced by enriching hydrogen from water gas sets with oil which, in turn, was mixed with coal gas to produce a higher Btu content.

In 1915, the company built and put into use a plant which utilized the method of distilling coal in ovens. The process produced by-product coke which could be used for metallurgical purposes. This by-product business helped keep its gas price down. The resulting sendout gas had a Btu content of 600—one of the highest rated manufactured gases made in the United States at that time.

When the U. S. entered World War I, Laclede Gas began making toluol, a coal by-product used in the manufacture of TNT.

During this period of coke oven gas, Laclede's laboratory gained national recognition for its experimentation in the destructive distillation of coals and for the production of a tougher, finer grade of coke. This work helped give impetus to the production of pig iron in the St. Louis area, and contributed to the establishment of several large steel plants nearby.

The gas company continued to market this coke by-product until 1950, when the plant was sold to



Retorts like this were used for many years by Laclede to provide St. Louis with high Btu oil gas before system was converted to straight natural in 1949.

Station A has long been a key point in Laclede's distribution system. Located just a stone's throw from the Mississippi river, Station A still is used for making high Btu oil gas for peak shaving.

Great Lakes Carbon Co. Great Lakes is still operating it.

During the middle 1920s, oil refineries on the east side of the Mississippi river were being developed at the terminus of long distance pipelines which brought crude oils from the Texas and Oklahoma fields. Refinery still-gas was made available, and in 1926 Laclede built a pipeline under the Mississippi to bring the gas to its distribution system. The still-gas was mixed with coal gas, giving added production.

Natural gas made its first appearance in the company's distribution system in 1932. Three years earlier, Mississippi River Fuel Corp. had completed a 431-mile, big inch pipeline from Louisiana to St. Louis. Laclede's management realized that it could augment its supplies of gas without additional large capital investment and plant outlay. The result was a contract that eventually made Laclede the pipeline's biggest customer.

General economic conditions and the ability to convert existing manufactured gas facilities to 100 per cent standby with relatively small capital investment determined the feasibility of Laclede's changing to mixed gas. On July 1, 1932, Laclede began sending out a mixed gas of 800 Btu content.

Raising the heat content of the sendout gas from 600 to 800 Btu meant that the gas company had to convert all appliances in its service area. The company estimates that its crewmen converted upwards of 1.5 million burners during the early months of 1932. As large as this job was, it was just a small preview of what had to be done 17 years later.

With the completion of the second natural gas pipeline into the area in 1949, Laclede began converting its distribution system to 1000 Btu straight natural gas. It involved the adjustment of more than 750,000 appliances for the company's 300,000 customers. They did it in record time.

The actual conversion work began in St. Louis County on May 16, 1949, and was finished in the city on Dec. 6. The city of St. Louis is served by a low-pressure distribution system, with medium pressure transmission mains. The county is served by a high pressure system. Naturally, different methods had to be used in the two systems.

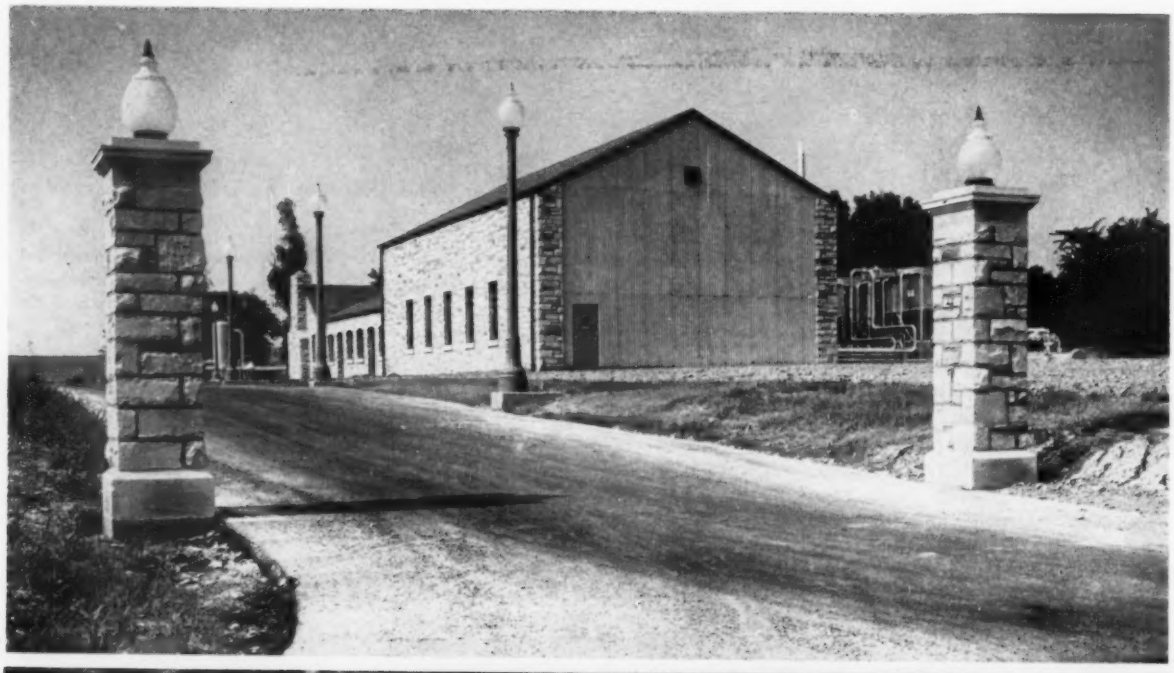
An intermediate gas to be distributed in the city during conversion was selected by the laboratory after testing several mixtures on representative appliances. Gas selected had nearly the same combustion characteristics as the old mixed gas, so the customer would not be unduly inconvenienced while the district was being converted. The company increased the pressure in the city system from an average of 5.5-in. wc to 6.5-in. wc during the time the change to natural gas was made.

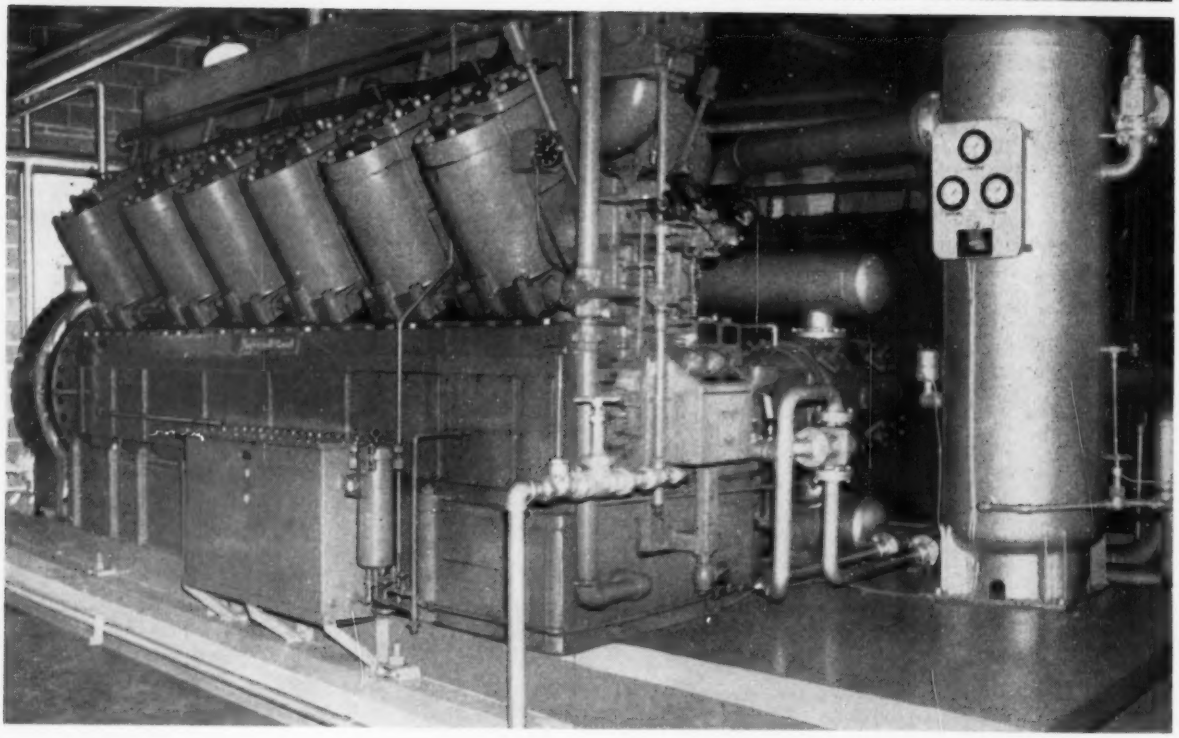
Intermediate gas produced a minimum of over-gassing before burners were converted, and a minimum of under-gassing after adjustment. This gas was a mixture of coke oven, air and natural gas, with a heat content of 880 Btu. When conversion work started in the city of St. Louis, intermediate gas was distributed to the entire area, and continued through the changeover.

The system in St. Louis county (acquired two years earlier) was high pressure, and completely valved. This made it possible to convert on natural gas by sections. The county was divided into 30 districts, the smallest containing 1000 and the largest 4500 meters. On the day work was to start, the district was isolated, the feeder mains purged, and natural gas turned in. Then the burners were adjusted for the new gas. The breakfast load purged the smaller customers' mains, but some of the larger ones had to be purged manually.

The city system had to be revamped during conversion. To sectionalize the area, 270 valves were installed, ranging in size from 3 in. to 24 in. The city was divided into 11 districts, ranging from 14,000 to 29,000 meters. A district was isolated, the pressure raised, and the burners adjusted on intermediate gas. Natural gas was turned into the district after all adjustments had been made. Purging of the mains was not necessary. Customer loads on the intermediate gas did this job.

Underground storage figures heavily in Laclede's future





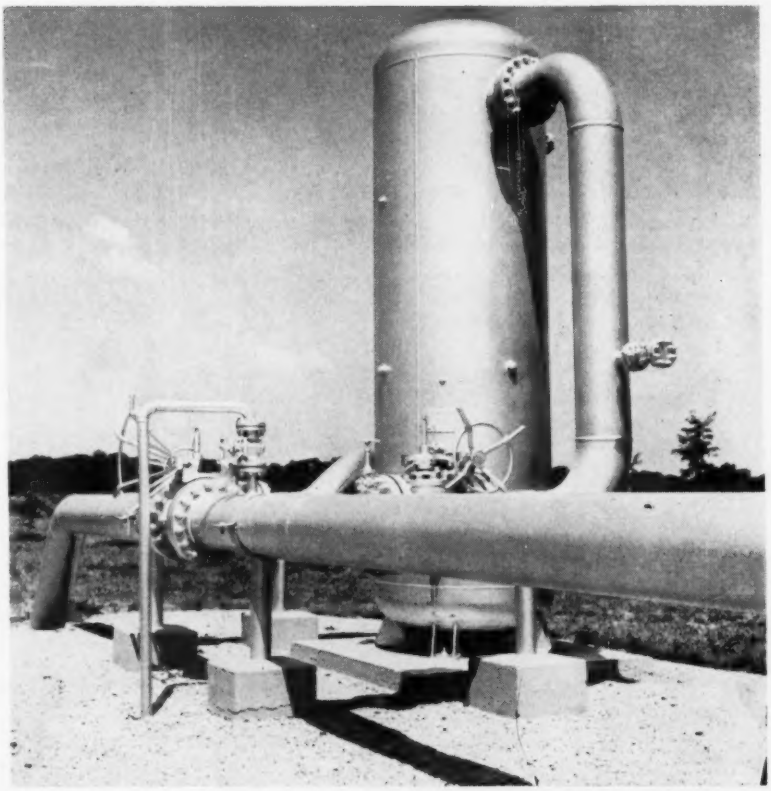
LACLEDE Gas Co. is now, and has been, faced with restricting the number of new househeating customers that can be added each year. It also is limited in the volumes of industrial and commercial gas that it can supply.

Although its peak day demands exceed the delivery from its pipeline supplier, they are not great enough to make another pipeline to St. Louis profitable. With a third line out of the question, at least in the next several years, Laclede went looking for another method of getting enough gas to meet peak day demands.

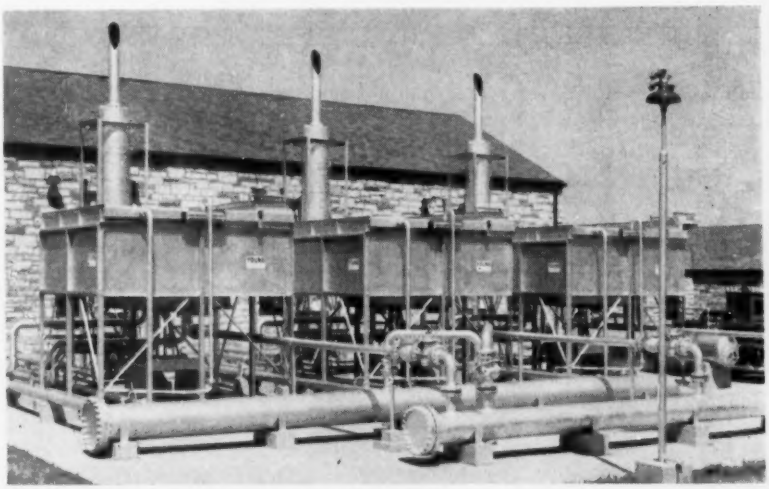
Storage is always a distribution company problem. Pipe-type holders to produce storage capacity the company needed would be tremendously expensive; aboveground holders would be even more so. The company felt that underground storage could be the answer.

Gas usually is stored underground in depleted oil or gas reservoirs. There were no such depleted fields near St. Louis. So Laclede began, in 1951, earnestly studying the State Geologic Survey maps. These maps showed an aquifer structure, similar to that which nature uses to store oil and gas, was located in Florissant, a suburb of St. Louis. Consulting geologists confirmed the state's opinion. In 1952, the company began test drilling. The first shallow test well was completed in September and some 40 additional shallow tests were drilled. The results indicated that the area might be suitable for gas storage.

In July 1953, the first deep well test was completed. This proved that the necessary reservoir and

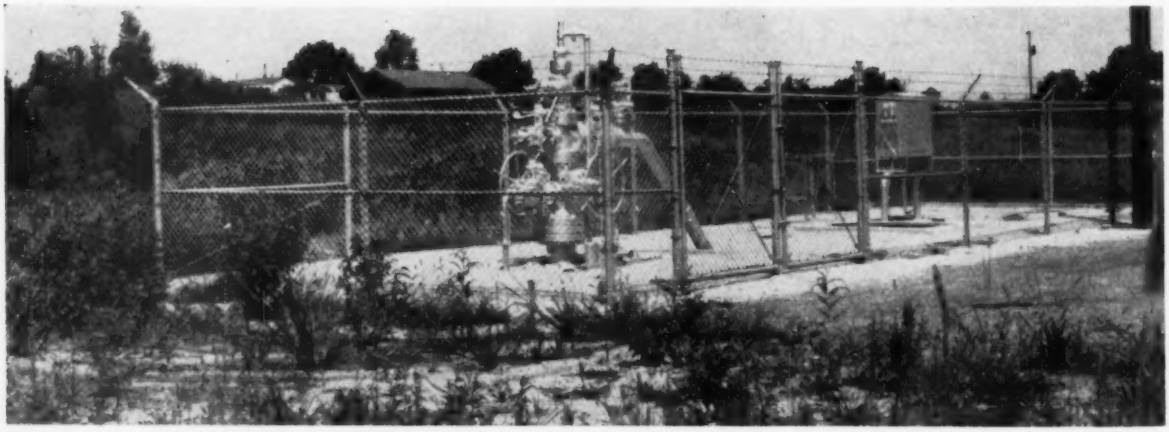


Incoming gas is scrubbed in this oil bath scrubber at Lange field before it is compressed and injected into storage wells.

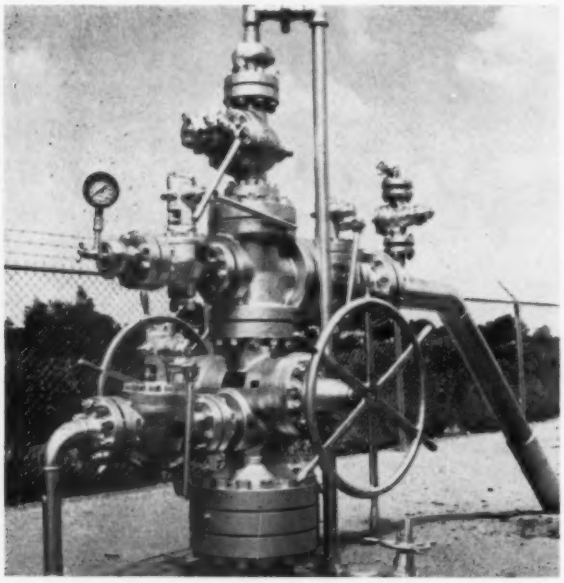


Exterior view of compressor station at Lange field, showing cooling towers and station discharge piping.

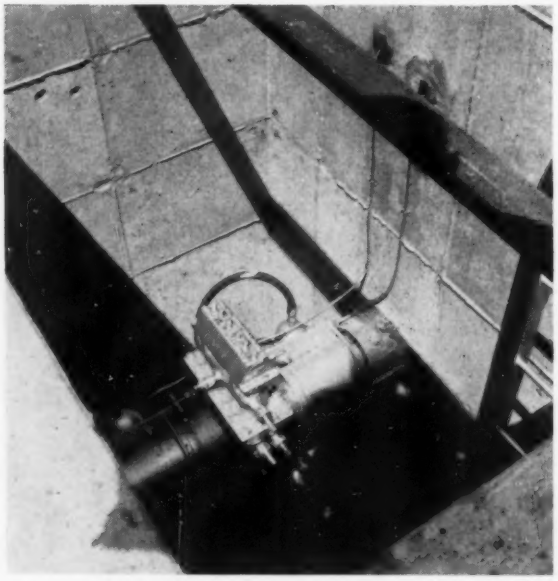
Compressor station at Lange underground storage field looks more like a lodge than a gas company installation. Lower picture shows interior of station. Three 660-hp two-stage compressors furnish compression for field.



This is one of the 13 injection wells located on the storage field. At left is the Christmas tree, at right the metering equipment.



Closeup view of typical Christmas tree at injection well.



Gas is metered at each well by an orifice fitting like this.

cap rock structure were there, and that the area would be suitable for gas storage.

Then the program was begun in earnest. By the start of last winter's heating season, the storage field (now called the Lange underground storage field) was ready to operate and help Laclede meet peak day demands.

The company feels that the field has an ultimate capacity of 30 billion to 50 billion cu ft. They will have 5 billion cu ft in the ground by Dec. 1.

Last year roughly 190 MMcf was withdrawn from the field, 65 MMcf during one sustained 90-hr period. Gas was withdrawn from the field when the temperature dropped below 25° F.

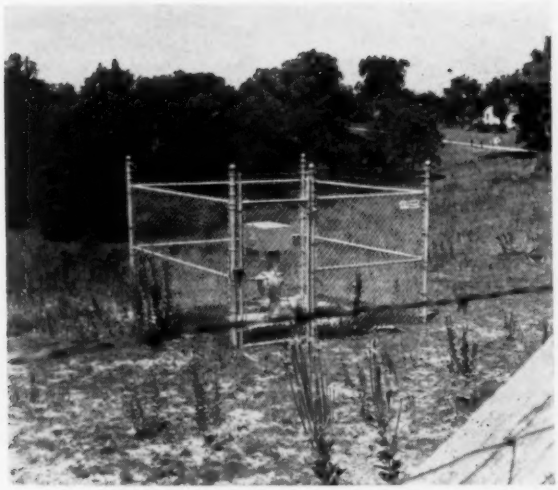
At the start of this heating season, Laclede will have 13 injection wells in operation. These wells are between 1350 and 1500 ft deep. During the offpeak season, gas is injected into the field at an average rate of 10 MMcf/day, with a top rate of 11 to 12 MMcf/day.

The gas company owns 100 acres outright (where the plant facilities are located), and has the underground storage rights for another 6000 acres under lease. In addition, Laclede owns a half-acre plot around each injection and observation well.

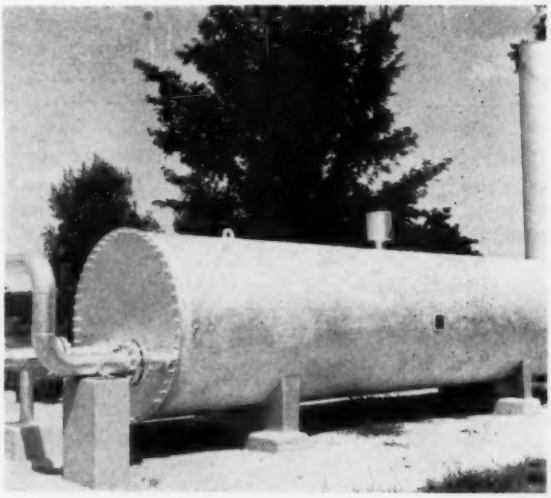
Gas is moved to Lange storage field through a 12-in. line which takes off from the north side of Laclede's system. Once the gas reaches the storage field, it is run through a Blaw-Knox oil bath scrubber, then metered through a Bristol differential type meter equipped with Daniel Jr. orifice fittings.

The gas is then compressed to 330 psig, cooled, and compressed again to 670 psig. (Compression at the Lange field station is furnished by three Ingersoll-Rand 660-hp SVG gas-fired compressors.) Again the gas is cooled (in

Drilling rig works on one of the 13 injection wells at Laclede's underground storage field in Florissant, Mo.



Water levels and pressures are recorded in seven observation wells located throughout the storage field.



During the winter, withdrawn gas is heated in this heater before being turned in to Laclede distribution system.

a Young fin-fan cooler), then piped to the field wells. The field piping system is made up of pipe graduating in size from 12- to 6-in.

When gas is withdrawn, it is run through a Black, Sivalls and Bryson heater, then through a regulator to cut its pressure to 150 psig. It is sent back into the distribution system by reversing the flow of the line which was used to transport it to the storage field area. Withdrawals can be started within 30 minutes after the dispatcher has ordered them.

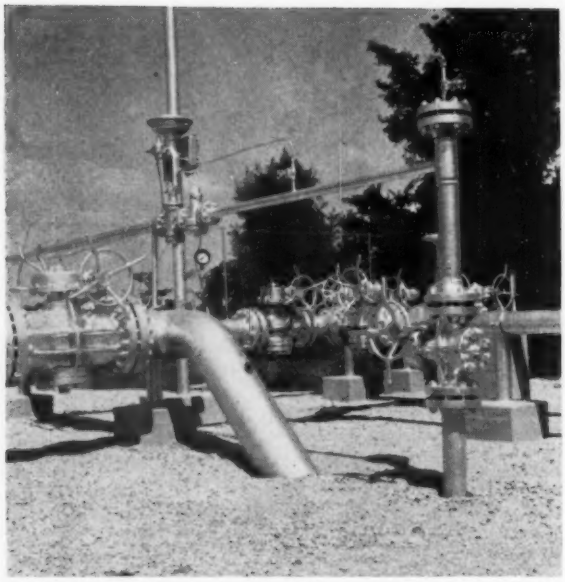
All 13 wells are identical. The Christmas trees are fabricated by Cameron Iron Works at its Houston (Texas) plant, and shipped in assembled form to Laclede. Each well is metered by a Bristol differential-type meter equipped with Daniel Jr. orifice fittings.

Seven observation wells are kept under close scrutiny by storage field personnel. These observation wells record the water level and reservoir pressure.

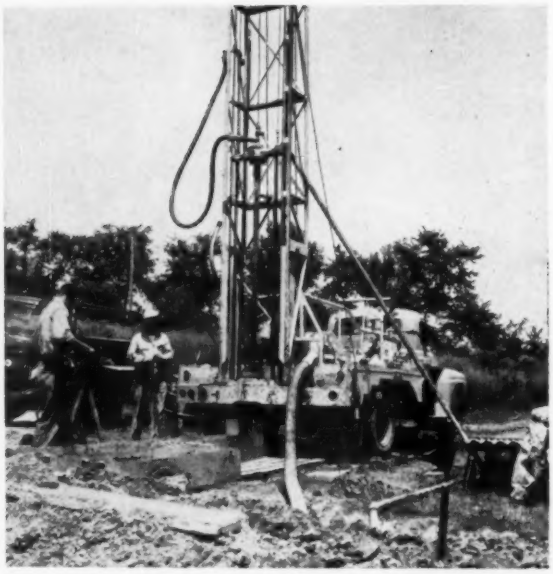
When Laclede began drilling gas wells, it also struck some oil. Now, somewhat by accident, the company owns 36 producers on the storage field property. Daily production averages 175 bbl. This crude is sold to Sohi Petroleum Co. and trucked across to Illinois.

A deep well recently was drilled by Eakle & Holder Drilling Co. (Evansville, Ind.) to pump out water from the strata and cut down the injection back pressure. For every Mcf of gas injected, 17 gal. of water must be removed. It is planned to drain 500 gal. per minute out of the water well. This water will be piped a few yards and drained into the Missouri river.

The company is still doing shallow drilling, too, in an attempt to more clearly define the exact limits of the underground storage area. These wells, drilled by drilling contractor Charles Hayes of



This view of station piping at Florissant, Mo., shows efficient arrangement of valves.



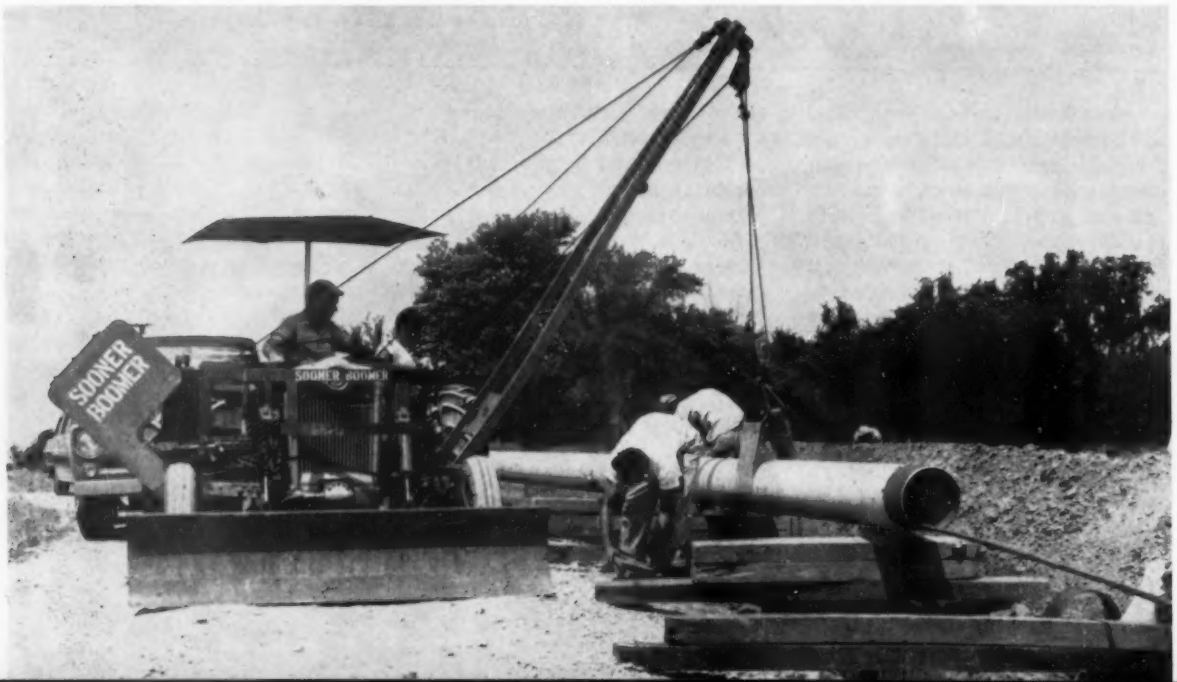
Contractor uses portable rig to drill test wells to 500 ft. More than 50 of these test wells have been drilled to date.

Urbana, Ill., go to a depth of 350 to 500 ft for stratographic tests. More than 50 of these wells have been drilled to date.

With the exception of the drilling and structures, all construction in the storage field has been done by the gas company's own crews. This includes such jobs as installing compressors and piping the station, and laying the complete piping system on the field.

When the company first announced its intentions to develop an underground storage field, some opposition was encountered from persons living in the area. However, this has been overcome. A good bit of this opposition vanished when Laclede began landscaping the storage field. At first glance, the main section of the field looks more like a golf course than a gas company installation. Shrubs have been planted, and are kept trimmed. The grass on the fields is well watered and cut. Station buildings are built of stone, and resemble a lodge rather than a compressor station.

Laclede has done all of its own pipeline construction in the storage field. Here a line is being laid to a new well.

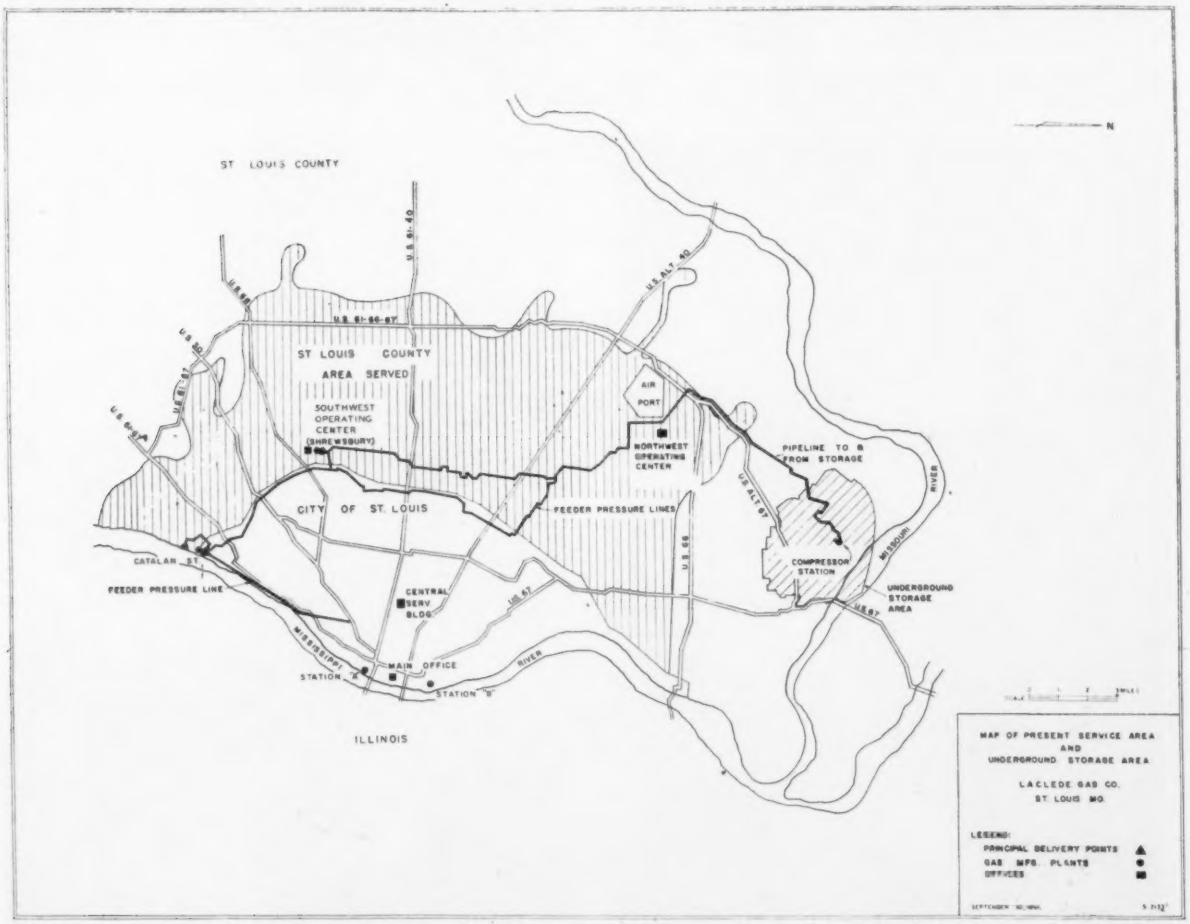


Company serves 370,419 meters through 2930 miles of mains

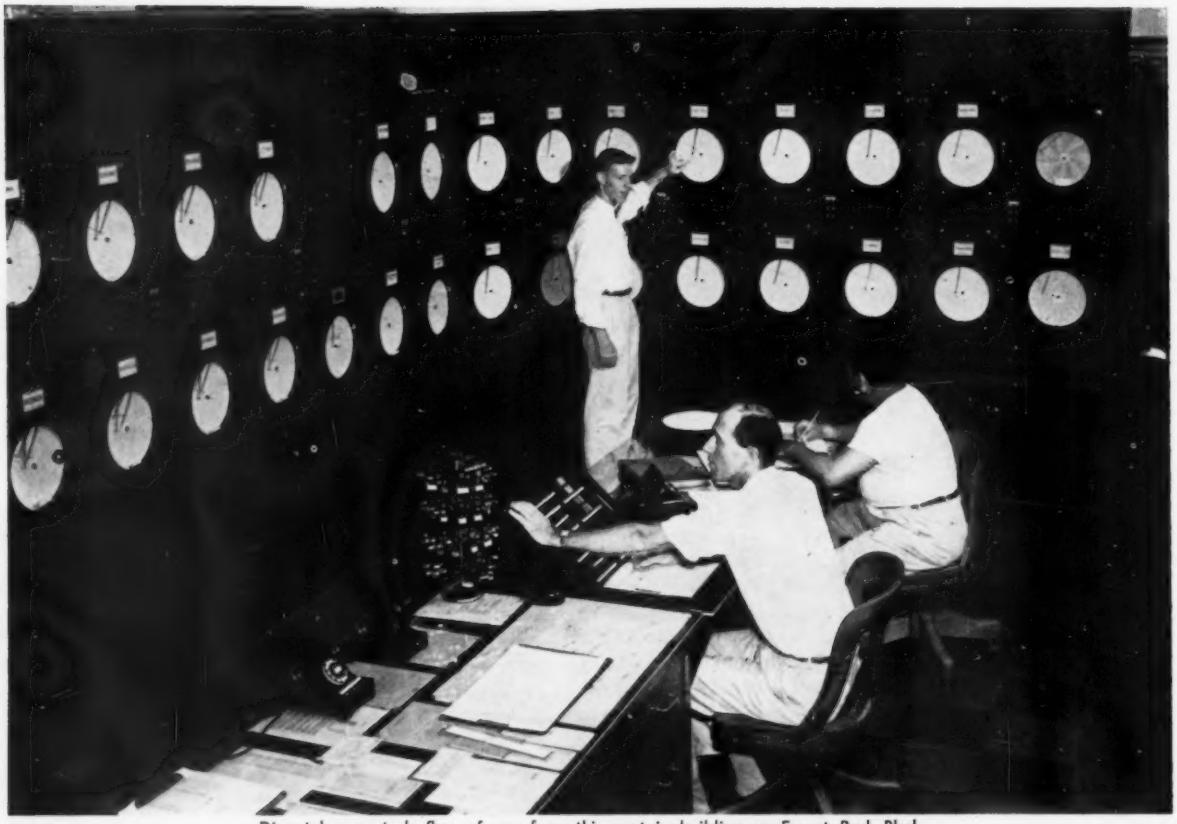
LACLEDE Gas Co. operates 2930 miles of street mains and 3260 miles of service pipe to provide gas service to its 370,419 customers in the city and county of St. Louis.

This system last year delivered 56 billion cu ft of gas to 84 cities and communities. Nearly all the gas delivered is natural, purchased from the Mississippi River Fuel Corp. pipeline at eight locations scattered throughout metropolitan St. Louis. On extremely cold days, Laclede peak shaves with either high Btu oil gas or LP-air gas.

The distribution system is roughly divided into two parts: St. Louis county, which is served through a high pressure steel pipe



Map shows the present distribution area of Laclede in St. Louis area.



Dispatcher controls flow of gas from this spot in building on Forest Park Blvd.

Laclede was the first gas company to install and use a flow analyzer.

network operating at 45 psig maximum, and the city of St. Louis, which is served mainly through a low pressure cast iron pipe system (4-in. to 8-in. w.c.), which is in turn supplied by a medium pressure cast iron system operating at 25 psig. The engineers who designed the first part of this medium pressure system in 1913 must have foreseen the future growth of St. Louis; the line's full capacity was not used until 1949.

The city system is the oldest. Some of the CI pipe in downtown St. Louis has been in service since at least 1860; other lines have been in the ground prior to 1890. Part of the pipe has been put in by Laclede, other parts of the system were installed by the three other companies that have since been acquired by Laclede.

The city medium pressure system and the county system is supplied from a high pressure belt line which runs roughly around three-quarters of the city limits with branch lines jutting into the county. This operates at a pressure of 160 psig. It was started in 1951. It supplies gas to the city and county systems through some 30-odd regulators which are remotely controlled from the central load dispatching office.

Feeder mains ranging in size from 12-in. to 4-in. serve most of St. Louis county. Two-inch distribution mains feed off, and operate at pressures varying from 2 to 45 psig.

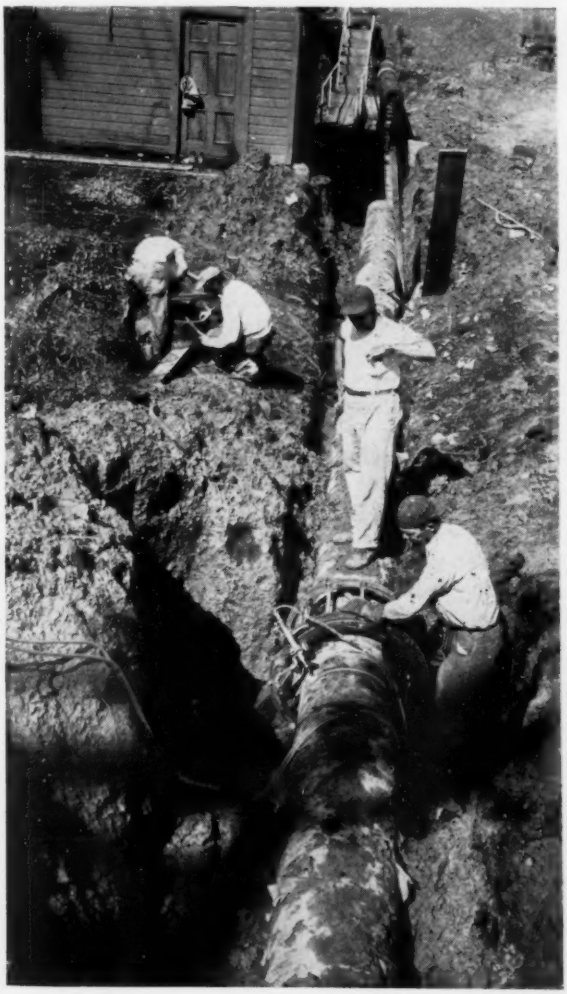
Gas for the entire Laclede system is dispatched from the company's operating center on Forest Park Blvd. in St. Louis. Thirty telemetrically controlled regulators (most of them on the feeder line) control the movement of gas throughout the system.

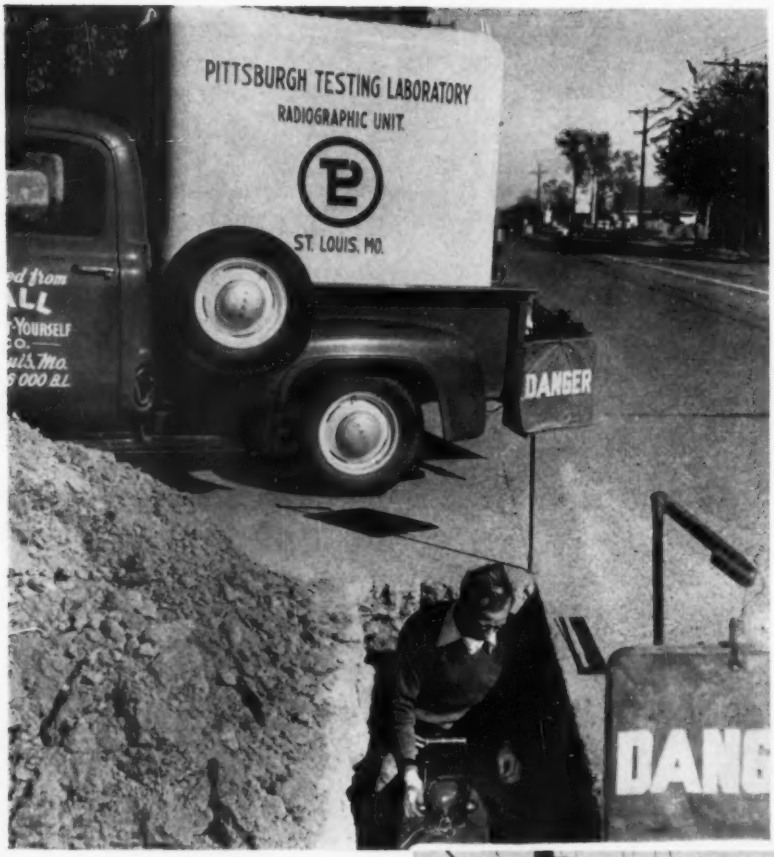
At the dispatch center, 15 flow meter readings are registered (including readings from five of the eight principal take points from the Mississippi River Fuel Corp. pipeline), along with readings from eight tag-end gauges. Laclede uses 75 leased telephone lines to operate its telemetering system.

Peak shaving facilities are maintained at three locations. High Btu oil gas is made at Station A and the Shrewsbury plant. LP-air gas is made at the Shrewsbury plant and at the Catalan station.

Ironically, Laclede now distrib-

Scenes like these two below were commonplace as Laclede converted its system to natural gas in 1949. At left, crew bores under busy Lindell Blvd. to lay new main. At right, main is being cut for installation of valve.





A familiar sight in St. Louis is this mobile X-ray truck. Operator here tests weld on main.

utes more manufactured gas on a peak day than it did when it was distributing only manufactured gas.

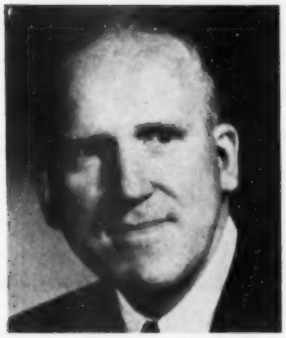
Laclede was the first gas company (in 1953) in the nation to begin using the McIlroy flow analyzer. Under the direction of Chief Engineer E. F. Trunk, the company has analyzed every mile of line. By the end of this year, the engineering department will have completed a system analysis showing what must be done to expand the system to handle two and one-half times the amount of gas it now handles.

Laclede's distribution department does all of its own construction. It owns and operates a large fleet of construction equipment which can handle pipe laying jobs of all sizes. The company has a contract with Standard Pipeprotection Inc. (St. Louis) for all coating and wrapping of steel pipe. The St. Louis branch of the Pittsburgh Testing Laboratory X-rays all pipeline welds under contract with Laclede. This X-ray work is handled by a mobile radiographic unit. ■

Laclede continues to expand its distribution system. This new line went in the ground in July, near the Lange storage field.

Robert W. Otto, President

A. W. Conover
1st vice president



J. Theodore Wolfe
2nd vice president

Vincent T. Miles
Treasurer

As this issue of GAS was being printed Mr. Conover asked that his name be withdrawn as presidential nominee because of illness. He will remain as first vice-president and Mr. Otto has been nominated for president.

St. Louis hosts AGA's 39th convention

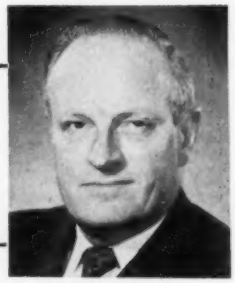
MORE than 4000 gas utility men, pipeliners, and manufacturers are gathering in St. Louis for the 39th annual American Gas Association convention. Sessions of the three-day meeting, Oct. 7-9, will be held in Kiel auditorium and four leading hotels.

Highlight of the annual convention will be the "Shoulders to the Wheel" luncheon on Oct. 9 in the Gold room of the Sheraton-Jefferson hotel. During this closing event, four leading industry executives will talk about the importance of continued unity among all segments of the gas industry. C. H. Zachry, outgoing AGA president and president of Southern Union Gas Co., Dallas, will present C. H. Murphy Jr., president of the Murphy Corp., who will discuss industry unity from the standpoint of the producer; Paul Kayser, El Paso Natural's president, speaking for the transmission segment; Marvin Chandler, president of Northern Illinois Gas Co., representing the distribution field; and Stanley H. Hobson, president of the Geo. D. Roper Corp., presenting the viewpoint of the appliance manufacturer.

General sessions will be held each day at 10 a. m. in Kiel Auditorium. James F. Oates Jr., president and chief executive officer of Equitable Life Assurance Society and recently resigned chairman of Peoples Gas Light & Coke Co., will address the opening general session on Oct. 7. "A Visitor Looks at the Gas Industry" is the title of his talk. James F. Healy, associate professor of industrial relations at Harvard's graduate school of business administration, is slated to address the Oct. 8 general session.

President Zachry, in addition to presiding at each general session, will deliver the president's address at the first general session. He will

DIRECTORS



Philip Beckman

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Robert E. Ginna

H. Hansell Hillyer

Chester L. May

S. H. Nichols

John Peterson

Edward Smoker

Henry Tuttle

S. D. Whiteman

give an up-to-the-minute report on the industry's rapid growth and prospects for future progress.

Two other major gas industry associations will be represented at other general sessions. GAMA's president, Julius Klien, who is also president of Caloric Appliance Corp., is scheduled for the Tuesday morning session, and J. J. Hedrick, president of INGAA and Peoples Gas Light & Coke Co., will speak Tuesday. His subject is "Just Plain Work Ahead."

Mrs. America of 1958 (Mrs. Linwood Findley of Arlington, Va.) and Miss Julia Meade, hostess on "Playhouse 90," will be introduced at a general session.

Among the nine achievement awards to be presented are two new ones: the Public Relations achievement award to the member company with the outstanding public relations project during the past year, and the Industrial and Commercial achievement award for the outstanding individual contribution to the promotion of the industrial and commercial use of gas.

Other awards include the Distinguished Service award, the Beal Medal for the best technical paper presented at an AGA meeting during the year, the Distribution Achievement award, the Operating Section award of merit, the Order of Accounting merit, the Safety Achievement award, and the Home Service achievement award.

All five AGA sections will hold meetings during the first two days of the convention. Operating, accounting, and residential gas sections will convene in Kiel Auditorium assembly halls. The home service group will meet at the Sheraton-Jefferson hotel, and the general management meeting is slated for the Hotel Coronado.

The first session of the operating section, scheduled for Monday afternoon, will feature talks by Major General L. E. Cotulla, staff director, petroleum logistics division, U. S. Department of Defense, who will report on activities of the Military Petroleum Advisory Board; Mark V. Burlingame, Natural Gas Pipeline Co. of America,

Clifford Coons

R. E. Crawford

Ed Parkes

John Parrott

D. K. Yorath

C. H. Zachry

speaking on securing, training and keeping technical personnel; and L. E. Heckman, Columbia Gas System Service Corp., whose talk is entitled "Advantages and Economics of Automatic Data Processing Equipment as Applied to Gas Control."

At the Tuesday afternoon session, Joseph A. Keller of the Washington law firm of Dow, Lohnes & Albertson will review communications and FCC action and its possible effects on the gas industry; Paul W. Kraemer, Minneapolis Gas Co., presenting the national field observation program for customer service; and J. H. Collins Sr., New Orleans Public Service Inc., who will discuss mutual aid in emer-

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gencies. SoCal's Grove Lawrence, chairman of the section, will preside at both sessions.

The accounting section is scheduling two afternoon meetings. Austin W. Merchant, Michigan Consolidated Gas Co., will preside at the Monday session. Speakers include Claude F. Wahli, Knoxville Utilities Board, "Keys to Customer Premises"; Erwin K. Taylor, Personnel Research & Development Corp.; J. H. Purdy, Baltimore Gas & Electric, "Customer Information Service and Electronic Accounting"; and Clifford H. Domke, of McKone, Badgley, Domke & Kline, "Dividends Out of Capital."

At the second session, presided over by Section Chairman James F. Daly of Long Island Lighting Co., Prof. Robert T. Livingston of Columbia University will speak. There will also be a panel discussion on present day techniques with ever-rising charge-offs.

W. D. Williams, New Jersey Natural Gas Co., will introduce the speakers at the residential gas section meeting on Monday afternoon. They are Sol Weill, Geo. D. Roper Corp., whose talk is titled "Worms, Strawberries and Lonesome Women," and John H. Brinker, A. O. Smith Corp.

Residential, commercial, and industrial gasmen will get together on Tuesday for a combined luncheon at the Sheraton-Jefferson. J. Theodore Wolfe, president of Baltimore Gas and chairman of the Gas Industry Development committee, will warn those in attendance that "Time's A-Wastin'."

Following the luncheon, industrial and commercial men will gather to hear Ralph T. McElvenny, American Natural Gas Co., speak on the future of the gas industry; East Ohio's John S. McElwain discuss the importance of adequate service for commercial gas equipment; and F. T. Brooks, Philadelphia Electric, who will ask, "Do We Get Our Share?"

Tuesday is the big day for the home service group. The day starts with an 8 a. m. breakfast at which AGA President Zachry and Managing Director C. S. Stackpole will speak. Also on the program is Bonnie Dewes of the D'Arcy Advertising Co., St. Louis. Participating in the afternoon roundtable discussion are Mrs. Mary Louise Bohn, Laclede Gas, who will report on a school contest; Margaret B. Doughty, Dow Chemical, discussing news in kitchen plastics; and Mildred Clark, Oklahoma Natural, who will suggest "Putting Gas on the Midway." ■

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F. T. Brooks

V. F. Büttner

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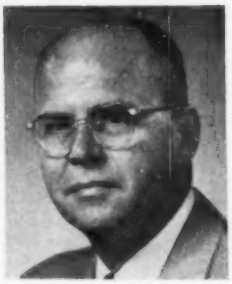

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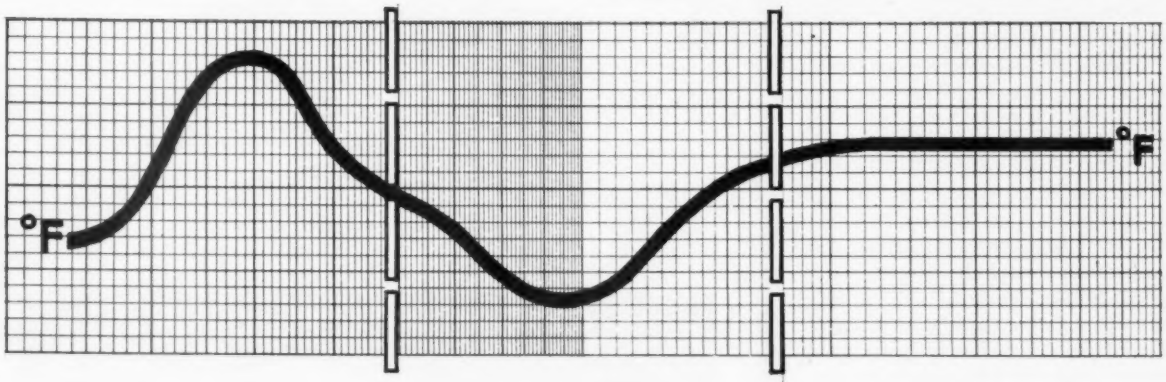
ZONE TEMPERATURE CONTROL...



What a serviceman should know about it

By LLOYD H. JOHNSON
Minneapolis-Honeywell Regulator Co., Minneapolis

This is the first of a series of three exclusive articles on residential zone control, from the point of view of the utilities serviceman. It deals with temperature control problems in the contemporary home, and how zone control, long recognized in commercial work, has proven beneficial in residential heating and air conditioning.

The second and third installments will illustrate and discuss the various zone control methods, devices, and what the utilities serviceman should look for in checking-out or trouble-shooting a zone control installation.

IN the course of a busy day, the typical utilities serviceman is exposed to a wide variety of burners, valves, relays, thermostats, and other equipment. In maintaining customer service, he is usually considered by the homeowner as the "expert" on everything pertaining to the heating plant—whether it is within his realm of responsibility or not. What he is expected to service is, of course, a matter that should be clearly discussed with his supervisor. However, this work will be easier if he is familiar with *all* types of equipment and systems he is liable to encounter.

Zone temperature control, once largely confined to commercial, industrial, and institutional buildings, today is becoming increasingly important in residential installations. As a result, the serviceman is going to encounter more and more of this type of control—especially in the newer homes. When

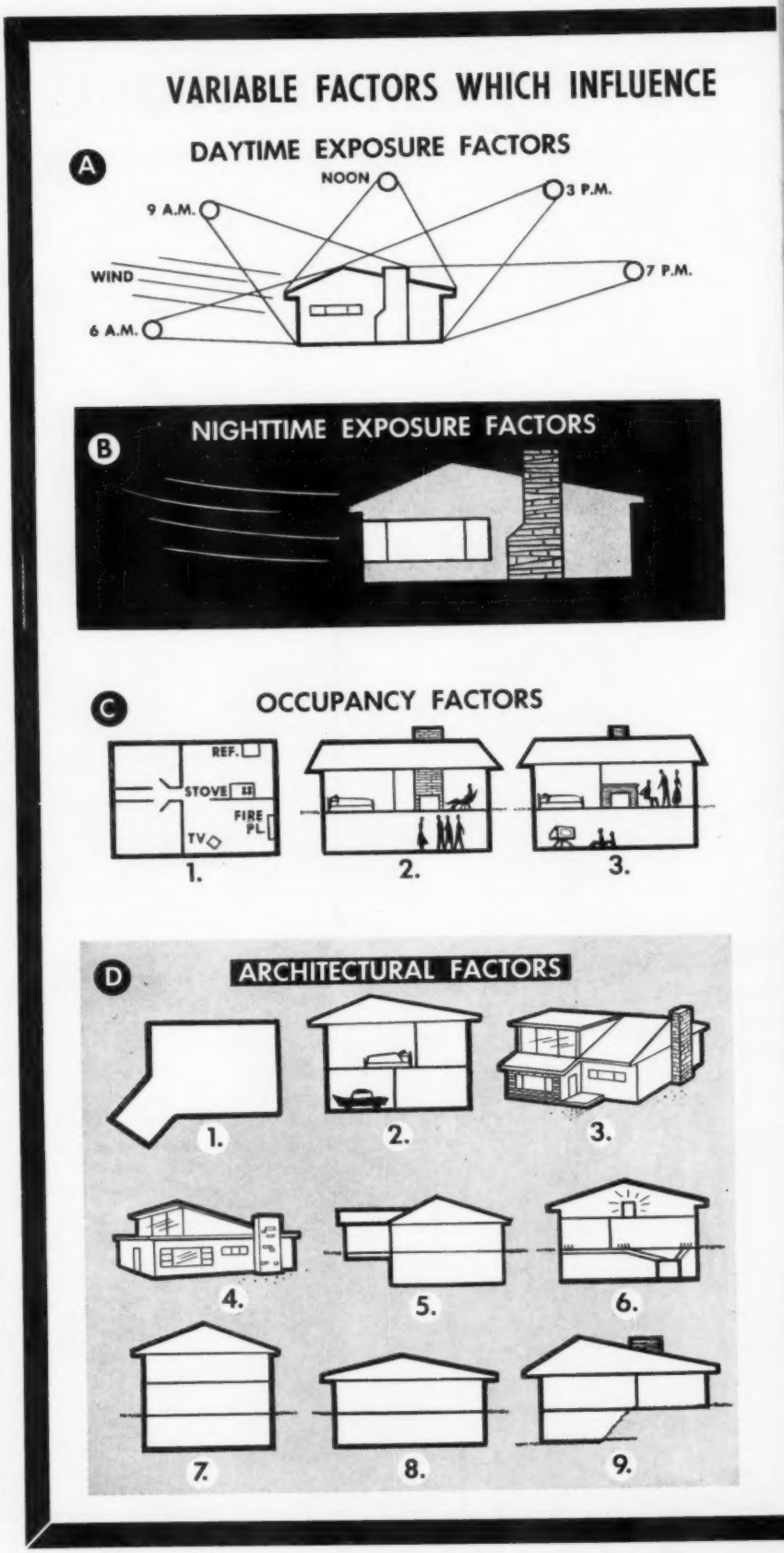
trouble-shooting or checking-out a system that includes zone control, it is desirable that the serviceman have an appreciation of the underlying reasons for zoning, as well as a knowledge of zone control systems and equipment.

Today, the structural characteristics of a great number of contemporary homes rule out the practicability of maintaining comfortable indoor temperatures with just *one thermostat*. Exposures differ widely. The heating or cooling load varies. So do the occupancy requirements. These changes are continuous from one hour to the next in various parts of the home. Today's comfort standards are also much advanced, compared with the early days of automatic heating when it was considered a luxury merely to have a thermostatically controlled heating system.

In analyzing the need for zoning, it is essential to consider thermostatic control and the limitations of the room thermostat. A thermostat, capable only of measuring temperature of air which immediately surrounds it, must necessarily be placed in a strategic position to regulate effectively the heating or cooling. Zone control permits unlimited flexibility in placing thermostats in each portion of the house having dissimilar exposure or occupancy conditions, as well as those areas where load conditions will widely vary.

While there is much more to a zone system than the application of a certain number of thermostats, the all important end result depends upon their temperature-sensing function. Each zone thermostat generally directs the positioning of a zone damper or valve operator which regulates the flow of the heating or cooling medium to the controlled area.

There are exceptions to the rule, depending upon the type of zone system, and control features it includes. Frequently these control features involve inter-related switching sequences that make zone temperature control a highly technical, precisely coordinated group of controls. The technical aspects of zoning will be discussed in following installments which specifically discuss zone control equipment.



TEMPERATURE IN A TYPICAL HOUSE

A. Daytime Exposure Factors

Exposures affecting heat losses and heat gains are continually shifting from one portion of the house to another. As the sun shifts through various positions from morning through late afternoon, heating and cooling load shifts with it. Low slanting rays in late afternoon easily penetrate certain areas of a house to create serious load unbalance. Chill winds which are characteristic in the early morning and late afternoon hours can also cause a need for heating in some rooms, while the rest of the house requires no heat.

B. Nighttime Exposure Factors

Because of an average 10° temperature drop due to the absence of sun, and an increase in prevailing winds, evening exposure factors are often completely reverse from those in daytime. Large glass areas, instead of being bothersome sources of excessive heat gain now tend to chill rooms because even sealed, double-paned windows have a heat loss factor that is *five times* that of ordinary frame outer wall construction.

C. Occupancy Factors

This differs as widely from one house to another, just as the size of family, range of ages and activities differ.

1. The living area of a home might be affected by such internal heat gains as caused by use of the fireplace, TV set, and from the adjacent kitchen, where the stove and refrigerator are operating.

2. Occupants might be engaged in separate activities in different parts of the house. Whether it is relaxing, sleeping, or active sports—each activity imposes different problems in temperature regulation.

3. Here occupancy conditions are completely reversed from the previous example (*Fig. 2*). A social gathering in the living area would demand little or no heat in this portion of the house, while children playing on the floor or watching TV in the basement recreation room would require considerable heating. In cooling, the load demand would be just the opposite.

D. Architectural Factors

1. Wings or other spreadout features of a home can have widely differing temperature requirements.

2. When living quarters extend over an unheated garage, both the heating and cooling load can be completely different from the rest of the house.

3. Varied wall construction can make a vast difference in heating or cooling load factors in certain portions of a home. Some portions might be predominantly masonry walls, frame construction, or largely glass areas.

4. High studio ceilings or clerestory windows always present heating and cooling conditions that are dissimilar to the rest of the house.

5. Heating requirements differ when the main portion of the house has a basement and other areas are basementless.

6. In modernized or expanded homes where the heat distribution system in the newer section is of a different type than that of the rest of the house, heating characteristics are never the same.

7. In a full two-story house temperature requirements differ from one floor to the next. In cooling, the load demand is completely reversed.

8. Even a single story house with a finished basement has different temperature requirements in the lower floor as compared with the rest of the house.

9. Split level homes have a separate temperature control problem with each level.

Temperature regulation in most contemporary homes is a complex matter. In a large share of installations, one thermostat would be about as effective as placing a single policeman at the busiest intersection on Main street. Hoping to maintain traffic all over town, he simply couldn't cope with the overall situation.

After studying the series of sketches which illustrate the variable factors influencing temperature in a typical home, *just where would you place the thermostat?*

Would you place it in the living room? No, too much of the time, you'd be bothered by direct sunlight pouring in through those huge picture windows. At night, that same glass area would be losing heat five times faster than other parts of the house. If there is a fireplace, that too would throw the thermostat all off. Would you locate the thermostat in the hall? Of course not. That would be like placing it in a closet. How about the bedroom, then? Certainly—if all you wanted to do was to maintain a comfortable temperature in the bedrooms. Placing the thermostat in the basement also wouldn't help conditions upstairs—but it would keep things cozy down there. If you've come to the conclusion that each of these areas (except the hall, naturally!) could use its own thermostat, you're absolutely right. Such a control system would be a thing of joy and pride forever—both for the serviceman and the homeowner.

The very features that make contemporary homes attractive to the buyer—plus the increasingly popular trend toward central year-round air conditioning—have multiplied the complexity of indoor temperature control. That is why builders, dealers, and homeowners are rapidly recognizing zone control as the logical solution to the many-fold problems of temperature regulation—both summer and winter.

As previously indicated, the concept of zone temperature control has been applied to commercial and industrial installations since shortly after World War I. In recent years, its need has become increasingly apparent in residential heating and cooling systems. With

highly localized temperature variations from room to room, and constantly shifting heating and cooling load conditions to which the present-day home is subjected, residential zoning has come into its own. Again referring to the illustrations, it becomes evident that the consideration of temperature control for each portion of the house is just as important as it is to carefully size ducts and registers, or piping and radiation. We all know that a well laid-out, properly installed job should not be considered a luxury. It should be considered a *must* where comfort control is important. Solid comfort in all parts of the house should also be just as important to the occupants of a $12,000 house as it is to those in a more elaborate home.

In any moderately priced home where more than mere basic comfort requirements are being met, zoning is warranted wherever any of the following conditions exist:

1. *Spread-out floor plan:* The more the home is spread out, the more the sun, wind, and outdoor temperature affect indoor conditions. Long duct or pipe runs and unequal exposures also make single thermostat temperature control ineffective.

2. *Finished basement:* Being predominantly below ground, heating and cooling requirements are entirely different from those in other areas of a house. Temperature here is largely influenced by the surrounding ground temperature, rather than widely varying outdoor conditions.

3. *Split-level design:* No *single* thermostat control system can cope with "rising" warm air and "dropping" cold air that makes rooms on one level unbearably warm, while another area suffers from under-heating. This is a common problem with cooling applications, also.

4. *Living-sleeping:* Here are two natural areas for zoning, because of widely differing occupancy requirements, structural characteristics, and exposure. It adds flexibility by permitting different temperatures and individual selection of day-night temperature settings if desired. If there is a fire place in the living room, it is especially important that there is a separate temperature control for each area. Also in the heating cycle, for example, it is both desirable and economical to maintain lower temperatures in the bedrooms during sleeping hours. In zone cooling, added flexibility is possible because cool air can easily be directed to the most occupied area, for added operating economy.

5. *Large concentrated glass areas:* During many hours of the day, with the sun shining, the parts of a home with large window areas gain tremendous quantities of heat (up to 350 Btu per hour for each square foot of surface). At night, conditions reverse, and the glass areas lose more than five times more heat than other wall areas. Wind increases this heat-loss ratio still more. Exact balancing of the heating or cooling system for all conditions is impossible, unless rooms with large glass areas are separately controlled.

6. *Rooms over unheated areas:* Rooms over garages, carports, and basementless areas have exposure problems entirely different from the rest of the house. Because garage doors are sometime carelessly left open, an added heating or cooling burden could be placed upon these areas. Unless separate control is maintained, such an area would frequently be subject to insufficient heating or cooling. ■

About the author

Lloyd H. Johnson, 47, sales promotion editor for Minneapolis-Honeywell Regulator Co., is recognized as an authority on residential zone heating.

He is the author of several Honeywell dealer manuals on zone heating which are considered among the most authoritative available. In addition, he has written many magazine articles on the necessity of zone heating in today's homes.

Mr. Johnson joined Honeywell in 1944 and held several sales positions in the company's Twin Cities branch sales office before becoming sales promotion editor. He majored in mechanical engineering at the University of Minnesota.

THE SERIES CONTINUES WITH . . .

Part II—November GAS

1. The basic structure of zone control systems.
2. Zone control system components, such as dampers, damper operators valves, and circulators.
3. Relays and wiring panels specially designed for zone control applications.

Part III—December GAS

1. Functions of controls used in a zone control system.
2. Detailed discussion of some control devices specially designed to operate in conjunction with other controls in a zone system.
3. The steps a gas utility serviceman might take in servicing a system equipped with zone control.

Good community relations are found in use of light-weight, wheel-mounted ditchers to install house services. Here small machine crosses lawn and sidewalk without damage to either.

Illinois Power adds town to growing gas network

A MOTORIST passing through Cambridge, Ill. on State Highway 81 might notice many things typical of small mid-western farm; the tree shaded streets, the courthouse square. But to a careful observer there is something not quite typical. Virtually every parking lawn and a high percentage of front lawns in town are bisected by a thin, well compacted but recently excavated line.

Soon more than 250 householders of Cambridge (pop. 1300) will be serviced with natural gas from the Michigan Wisconsin pipeline which passes within a few hundred yards of the village limits.

Despite the "small town" aspects of the job, the installation involves a major amount of trenching; some 14,000 ft of services; 34,000 ft of 2-in. main; 7000 ft of 3-in. main and 9000 ft of 4-in. main.

One decision of the local supplier, Illinois Power Co., has been to use trench sizes no larger than absolutely necessary for the pipe to be installed. Since virtually every foot of installation passes across the well tended and highly prized lawns and parkings of the community, this action has been approved by the residents. Actually by summer's end most traces of the excavations were covered by a new growth of grass.

Three ditchers were used for the installation work. The largest, a crawler-mounted Cleveland 95, was used only to install the 4-in. main and a part of the 3-in. main. A rubber tired digger, a Barber-Greene Model 705-B "Runabout," was substituted by the contractor for most of the 3-in. main and all of the 32,000 ft of 2-in.

To reduce further the possibility of lawn damage, a still smaller machine, a rubber-tired Barber-Greene Model 702, was used for the 14,000 ft of services. This latter machine, which weighs just a little over 1 ton, is mounted on two large tractor-implement tires and a pneumatic-tired castor. It digs 3 in. wide and 40 in. deep, which range is more than adequate for the service work. Self propelled, the little machine has kept up an average of about 15 services per day. The operator drives it from job to job himself.

The Cambridge job began on April 22 and was scheduled for completion by July 15. However, between April 22 and June 22 the rain had been so heavy and so frequent that it had been possible to work for only 32 days. Despite these delays, the mechanization of the job had brought it to 85 per cent completion by the end of June and it then appeared that the "target" of July 15 would not be far missed, if at all.

All of the trenching and pipe installation on the Cambridge job was contracted to United Pipeline Contractors of Beloit, Wis., whose personnel and equipment were responsible for the success of the operation. Much of this success has been credited to United's first job superintendent at Cambridge, Pat Patchy, who, tragically, was killed in an automobile accident on June 21. Mr. Patchy was replaced by Ben Carter, who saw the job to completion. Coordination between the contractor and the Illinois Power Co. was handled by IPC's inspector, James McNicol. ■

Ditchers are never permitted to get far ahead of pipe crews. Here a crew puts in a house service almost as soon as the trench has been completed.

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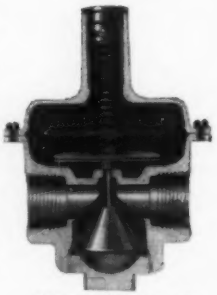

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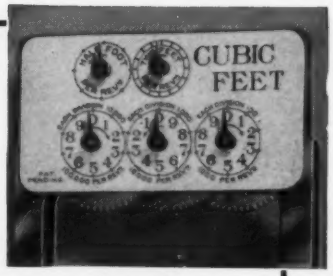

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Quality control of peak-shaving gas mixtures

By DWIGHT K. TAYLOR
Connelly Inc., Chicago

ALTHOUGH this article is about quality control of peak-shaving gas mixtures, perhaps it is a good idea to start by reviewing a little the history of the development of the Connelly Caloroptic, and what it is.

It must have been 25 years ago that the Lamphier patent was issued. It covered the basic idea that if a Bunsen burner is set up with a fixed orifice, and a fixed pressure of gas on that orifice, within certain limits, a change in heating value is accompanied by a proportional change in the primary air required for complete combustion. And if the primary air slide is of such a design that the change in the area can be reflected in its calibration, then the reading of the air slide can directly indicate changes in Btu value.

Of course, we must recognize that there is an error in this logic, as no doubt the air requirement really varies with what we now call the "flame factor," which is Btu divided by the square root of specific gravity, and by changes in chemical constituents in the gas. But if the Caloroptic is calibrated on the gas on which it is to be used, then the normal changes in Btu are almost a straight line function with the air requirement because on one particular gas the changes in specific gravity, when the square root factor is taken into account, are relatively small.

The instrument is more properly termed a secondary standard be-

cause it must be calibrated, or set, for each individual gas. Under no circumstances should it be considered a substitute for a Bureau of Standards flow calorimeter, which is considered a primary standard.

As time went on, improvements were made. The instrument was put in a metal box to reduce the effect of drafts on the burner, and we found that the primary reason for any change in calibration was collection of dust on the orifice. So we added a small filter ahead of the regulator. With preliminary practice, an operator can check read within 1 or 2 Btu.

These instruments have been spread across the country and have filled a need, particularly in the smaller companies, for a ready reference standard. They have been very popular in conversion work, due to their portability, particularly where cities were converted by the isolation method—a few blocks or sections at a time. This enabled the conversion crews to establish that the new gas had reached the point at which they were working.

Years ago, A. L. Smyly of Connelly Inc., bought the Lamphier patent. Later he obtained an additional patent, which covered the application of a photo cell to watch the burner flame.

The primary air shutter was closed slightly to produce a slight deficiency of air, thus producing a yellow flame. The amount of luminosity was measured by a special photronic cell, made for us by Weston Electrical Instrument Corp. The output of the photo cell was in turn measured by a Weston microrelay.

Frank Carpenter, at that time a Phillips Petroleum engineer, stimulated Connelly to develop a safety control panel, which found its application in the propane-air field.

Over a period of about 10 years various alarm combinations were worked out and installed in many propane-air plants, principally in the Midwest. These took their cue from the early desire of these plants to have a safety system by which, if the Btu value went either too high or too low, they would have an automatic alarm and shutdown.

In some of the smaller plants—for example, when the Plant at Newton, Iowa installed its propane-

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air equipment—it was arranged that a telephone alarm would ring in the police station. The desk sergeant on duty had a list of gas company personnel who were notified to go to the plant to fix whatever trouble appeared on the indicator panel. Thus the plant, which was automatic in operation, could be left completely unattended.

This type of operation helped many small companies to have more economic operation.

In about 1954 we asked ourselves why we had not adapted the Caloroptic to control? Of course, previous to this time most of the measuring instruments were not sensitive to changes of 1 or 2 microamperes, at say 15 milli-volts. However, we started our experiments, using a Weston relay with magnetic reset action. This, with a bunch of relays and an interrupter of our own design, allowed us to pulse an electrically motorized valve, thus modulating the ratio of air to propane.

Actually, in the first trial in a plant, the United Petroleum Gas Co. arranged for us to spend several days at the Wilmar (Minn.) Gas Co. This was a compressor-operated plant, with a zero regulator on the propane admission. We merely put a motorized butterfly valve on the air inlet pipe and partially choked off the air inlet, thus making the Btu rise a controlled amount.

We were so pleased with the results of this preliminary test that we decided to further investigate the field of instrumentation. The war had required development of more sensitive instruments. It was really the beginning of the age of automation. We, therefore, contacted several of the major instrument manufacturers, and asked their help in solving our problem.

Minneapolis-Honeywell Regulator Co., Brown Instrument Division immediately jumped into the picture; and we assembled several Caloroptic instruments, together with the Brown Electronik recorder controller. We tried them out at various locations.

One of them sent out in the field, and tested as a Btu recorder, was found wanting. This was before we realized that on a mixed gas job the inverse function of the square root of specific gravity would be important. (We should state right now that under no circumstances do we consider our instrument at a Btu recorder per se; but rather a controller where we are anxious to automatically compensate for the effect of change of specific gravity.)

Since we were worried about this specific gravity change matter, we looked around the country for a location where the control of enrichment was desired, and at the same time wide swings of specific gravity would take place. At Waterloo, Iowa, we found ideal conditions for a test. That plant was, at that time, using the surplus gas from the sewage treatment plant, which was largely methane, and averaged around 700 Btu. They added oil gas made on two converted water gas sets, of such de-

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This article is adapted from a talk presented at the NEGA operating division meeting in Providence, R. I., May 16, 1957.

sign that the specific gravity of the gas produced on the two sets was quite different. To this mixture was added a variable quantity of propane-air.

They decided to regulate the Btu of the final mixture by addition of straight butane vapor. Our first controller was installed and a report of its operation was made by R. M. Schoger, plant engineer. They were particularly pleased with the fast response in correcting Btu swings caused by sudden load changes.

Prior to the use of the Caloroptic controller it took from 40 minutes to an hour to correct the Btu level when the pumping rate was increased—for example, just before the dinner load. This correction was made within a matter of seconds with the Connelly controller.

As Mr. Schoger reported, the operation was done with an electric output signal from the controller through an interrupter—of our design—which modulated the position of a motorized valve, controlling the butane vapor admission.

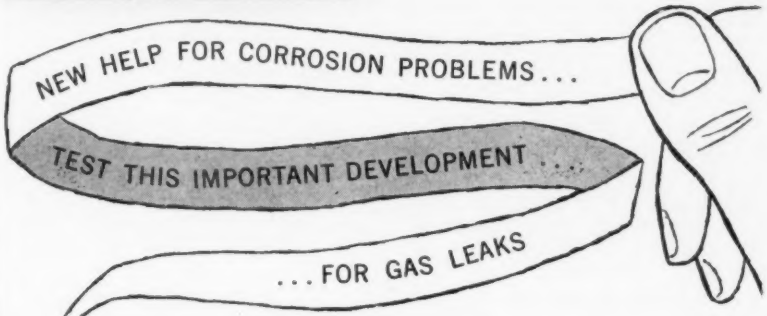
Like everyone else today, we soon had to be educated on the application and advantages of pneumatic control. We were very pleased, therefore, to be able to work with Paul Joy and Howard Hole of the Honolulu Gas Co. in providing them with a pneumatic output instrument, which regulated the amount of dilution air to stabilize their Btu.*

All operating men today are very safety conscious. At Honolulu they carried this to the point of having a separate Caloroptic set up as a safety control instrument. One Caloroptic was mounted in one side of the cubicle, and connected with the controller. Another in the other side of the cubicle was connected to operate relays, which could produce shutdown and alarm should Btu vary too far from the expected standard. Several other installations have been made using similar equipment.

It was during 1953 and 1954 that a great deal of study was given to this matter of peak-shaving. It appeared that all the stud-

* See "Honolulu Gas' experiences with high-Btu oil-gas," by George B. Tuggle and Paul C. Joy. April 1957, GAS, pages 42-49.

INVESTIGATE THIS TIMELY MESSAGE!



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Quality control . . . Speed of response and closeness of control are advantages

ies made by American Gas Association, and member companies, with regards to substitutability, and interchangeability, indicated that if we could make a supplemental gas, and change its Btu value in order to hold the flame factor constant, we would have the minimum amount of trouble from customer appliances.

A study was made by Washington Gas Light Co. This company came up with a curve showing that if the percentage of propane-air increased in a mixture with natural gas, that the Btu of the propane-air should be increased. This, of course, as we look back on it, seems quite simple, but I believe that we in the gas industry were a little slow to recognize this point. Perhaps we should not blame anyone, because the subject was only becoming important at that time.

Another way of stating the problem is—If we have a base load of natural gas, and if we add a very small amount of propane air, the increase in specific gravity caused by that propane-air will be only very small. Hence the Btu of the propane-air added need only be a slight amount over the Btu of the natural gas, to offset the small increase in specific gravity.

As the percentage of propane-air rises, the gravity, of course, goes up. And hence, Btu should go up more to keep flame factor constant. We eventually, as we go far up the curve, arrive at the 100 per cent propane-air point; and you all know that, depending upon the Btu and gravity of the adjustment gas, the Btu of propane-air should be somewhere between 1300 and 1500 Btu. And, of course, the reason there has been considerable discussion between various investigators as to what this interchangeable value should be is simply because they were starting with a different adjustment gas.

In the summer of 1954, A. H. Hartley Jr., Lake Shore Gas Co., Ashtabula, Ohio, asked us to consider designing a plant that would produce as few customer complaints as possible. While we did not feel that we were in the engineering business we were willing to take on the job, with the assistance of Charles Sharp, of the Cleveland office of Brown Instrument Division. The three of us together worked out the design.

It seemed logical that if the demand rate was based on a daily peak, if the dispatcher could anticipate this peak, and if we would add the propane-air continuously during the period; there would be less violent change of burning characteristic on the customer appliance than there would be if we dumped a tremendous quantity of propane-air into the line within a few hours.

As all of the natural gas for the town of Ashtabula passed through the station, it was possible to con-

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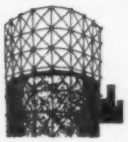

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struct a pipe loop through the propane-air mixing room in between stages of their natural gas pressure reduction.

A Brown instrument ratio controller, with adjustable index, was installed so that the dispatcher could set, at will, the percentage of propane-air to be added. This ratio controller directly modulated the position of a flow control valve in the propane-air mixture stream, just before it entered and mixed with the natural gas.

The propane-air mixture was also controlled by a ratio controller, the output signal directly modulating a pneumatically operated valve in the propane vapor line. A sample of the final gas mixture is burned by the Connelly Caloroptic. The flame factor is measured by an Electronik recorder controller, which, through a ratio relay, modulates the air flow signal on its way from the air flow meter to the propane-air ratio controller. Before start-up the Caloroptic and the Electronik recorder are set on zero for 100 per cent natural gas flow. As the propane-air begins to dilute the natural gas, the controller raises the percentage of propane in order to maintain a constant flame factor in the final mixture. The big advantages of this system are in speed of response, and closeness of control.

You all know that we must have a fast and accurate sample of the gas mixture. We, therefore, put a pressure reducing regulator very close to the main, so that the gas will be expanded as much as possible in the sample line. The sample line is kept small, preferably ¼ in. copper tubing, and run as directly as possible to the Caloroptic instrument.

A tee feeds the Caloroptic, and then beyond this point a large purge burner is installed, so as to make the rate of flow through the tubing as rapid as possible. Perhaps the biggest advantage of our Caloroptic is that as soon as the new gas gets to the burner we have immediate response from the photo cell, there being no other apparatus, meters, etc., to purge out.

The new job just completed at Bryan, Ohio, figured a four-second response time to institute corrective action. With this kind of time

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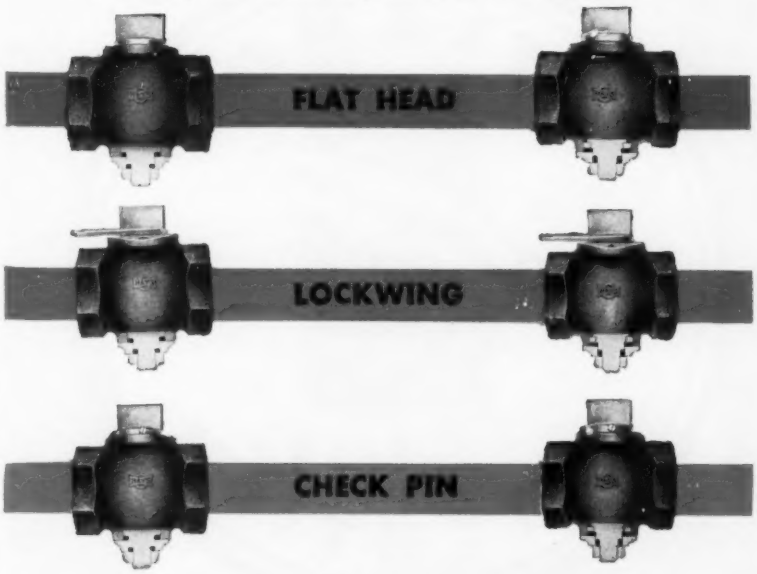

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quality control . . . Pneumatic ratio controlled systems have inherent advantages

not very much poor gas can get by before correction takes place. There are certain other inherent advantages in the modern pneumatic ratio-controlled system; the orifice meter is very compact, and with the Brown differential converter, only a single air signal line has to be run from it to the instrument, which, of course, reduces installation cost and makes for simplicity.

One of the criticisms that is usually made of a system that depends upon the orifice meter is low turndown ratio. By this is meant that if we design an orifice for a flow of 100,000 cu ft per hour, we would not expect to have very great accuracy below about 10,000 cu ft per hour.

It so happens that we ran into this problem at Bryan, Ohio. And, of course, while it is not expected that a peak-shaving plant would have to run at such a small percentage of design rate very often, we solved the problem very easily by putting a bypass on the air signal line so that we would not have to depend upon the flow of the air through the orifice to establish the proper propane-air ratio. We let the Electronik flame factor controller directly modulate the index on the ratio controller.

While it is argued that this may reduce the sensitivity of the system slightly, we fail to find it so in actual practice, and believe this to be a sufficient answer to those people who must have a wide flow range.

Of course, it is possible to simplify this system even further, and have the Electronik flame factor controller directly modulate a flow control valve. We would then, of course, be eliminating all metering and many of the safety factors which are possible in the system set up at both Ashtabula and Bryan.

We have not gone into the subject of safety with much detail in this article. Both of these latest plants have included all the safety features that anyone concerned could think of. Automatic shutdown occurs on low propane, or low air pressure; low vapor temperature; low Btu or excessively high Btu, as determined by a separate monitoring Caloroptic. Lack of flow in either air or propane also automatically shuts the plant down. We also have automatic shutdown, with a battery-operated alarm, should electric power fail.

On the Bryan job we even trip out a relay which shuts the compressor down. Of course, both the propane flow valve and an air safety shut-down valve are spring closing, so that if there were any failure they would automatically close.

We do have simple safety package units, but we feel that such safety systems should be fitted to the individual user's needs. ■

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Unparalled safety is but one of the features of WEBSTER'S revolutionary non-premixing ring gas burner incorporating flame retention regardless of air velocity.

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GAS news

End of heating limit forecast in Michigan

After granting Michigan Consolidated Gas Co. permission to add 80,000 more househeating customers, Michigan PUC members indicated the authorization might be the forerunner of a ruling to remove all gas heating restrictions in the state before winter.

With the authorization, Michigan Consolidated will be able to provide heat for 580,000 homes. However, a company spokesman expressed doubt the full number will be reached this winter.

The PSC ruling followed months of deliberation and public hearings at which the company said the existing supply of gas would justify the additions. Opposing the authorization was Panhandle Eastern Pipe Line Co.

The pipeline company has been trying to cut its association with Michigan. In the course of the hearings, Panhandle demanded that the utility not count its supply as a permanent source in its bid for increased gas heating service. The PSC order, however, emphasized that Michigan has sufficient supply apart from Panhandle gas to take care of the extra 80,000 heating customers.

West Virginia court petitioned in rate case

United Fuel Gas Co. has taken exception to the manner in which the West Virginia Public Service Commission, in one portion of a rate increase order issued in July, applied principles laid down by a supreme court decision. As a result, the company has asked the state supreme court for a review of the PSC order, which granted the company a million-dollar rate increase.

The court's July decision set aside a 1955 commission order which granted United only about

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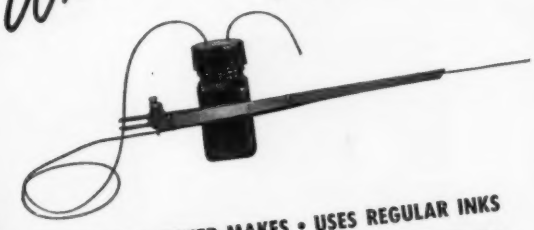

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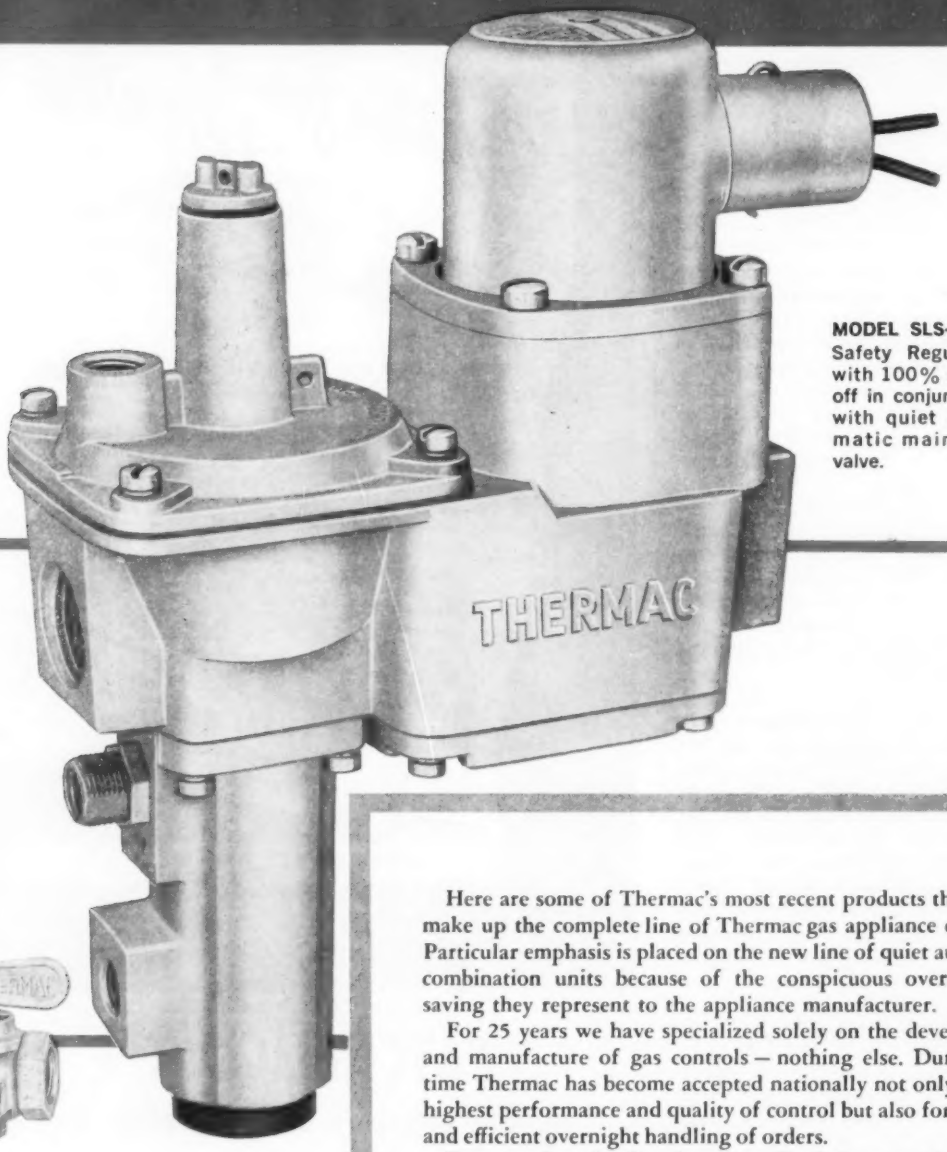

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MODEL P-300
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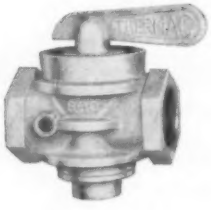

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For complete details of any or all of the controls shown, please write, wire or telephone –

While a representative few of Thermac's products are shown here, there are several hundred other models from which to meet your specific requirements.

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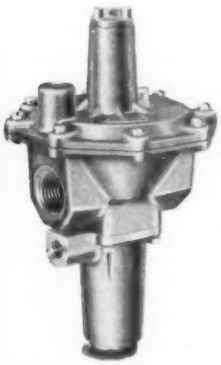
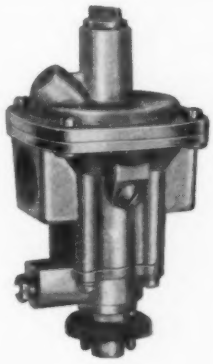
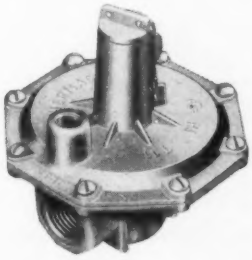


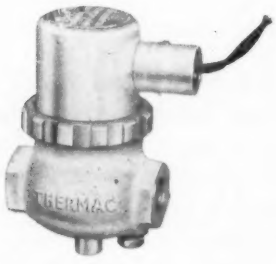
MODEL SL-200
Combination pressure regulator and thermo electric safety.



MODEL SR-100
Combination pressure regulator and thermo electric safety.



MODEL T-11
Gas appliance regulator.



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one-fourth of a requested increase. The PSC then issued the July 15 order granting higher rates calculated to add $1,032,000 to United's annual gross revenue.

Spokesmen for the utility said that points raised in the new petition, if sustained, would add about $200,000 to the amount of higher rates authorized in the July 15 order.

The company contends in its new petition that one finding in the PSC order represents an erroneous interpretation of the supreme court decision. The disputed finding stated that, in calculating costs as a basis for rates, "all natural gas production and gathering, products extraction, and exploration and development costs" should be allocated as commodity costs—costs which vary directly with the volume of gas.

United Fuel contends that the court opinion required that the "demand element" should have been taken into account in classifying natural gas production costs.

What's Briggmann looking at?

George Briggmann, UNION CARBIDE's specialist in the use of CARBOSEAL Anti-Leak, is inspecting another bell-and-spigot joint effectively sealed with CARBOSEAL Anti-Leak. Municipal gas companies have found CARBOSEAL Anti-Leak the answer to problems resulting from the changeover from wet manufactured gas to dry natural gas.

CARBOSEAL Anti-Leak swells dried out packing fibers in bell-and-spigot joints—thus, it solves four problems because it:

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In other rate actions across the country, Northern States Power Co. asked the St. Paul (Minn.) City Council for a rate increase of about 75 cents per month for the average residential customer. Northern States proposes to delay the effective date of the increase, if allowed, until February 1958 to enable customers to share in a refund from Northern Natural Gas Co.

The Cheyenne (Wyo.) Light, Fuel & Power Co. has been authorized by the state public service commission to put in effect a rider on present rate schedule to increase rates and charges. The temporary authorization is contingent on Cheyenne's supplier, Colorado-Wyoming Co., getting a requested increase okayed by the FPC. The boost would up residential and commercial rates by 2.16 cents per 100 cu ft of gas used per month; interruptible users, 4.11 mills per Mcf per month; and special contract users, 1.89 cents per Mcf per month.

IGT's combustion study published

Under the sponsorship of the American Gas Association's PAR plan, the Institute of Gas Technology has conducted an exhaustive search of literature on the theory of combustion, combustion phenomena, experimental investigations of various phases of combustion, and certain fundamentals important to burner design.

The use of gas as a source of energy is inextricably linked with the combustion process. Developments in the combustion field have been greatly accelerated with the advent of jet propulsion. Many of these developments are of direct interest and possible application to the gas industry. With this in mind, IGT has published its Research Bulletin No. 15, "Fundamentals of Combustion of Gaseous Fuels—A Critical Literature Review," by S. A. Weil, R. T. Ellington, E. F. Searight, and S. Hu.

United Gas cited for college fund contributions

Among the 10 companies and foundations honored by Marquis-Who's Who Inc. for gifts to independent colleges is United Gas Corp., Shreveport.

United gives $25,000 annually to the Louisiana Foundation of Privately Supported Colleges & Uni-

versities. The citation reads in part, "At this stage of progress in corporate giving to education, the gift of a corporation to a state association of colleges for the purpose of carrying on the work they are doing in presenting the case of those colleges to other industries is particularly worthy of note."

The contribution from United Gas is for operating expenses of the foundation. Any balance at the end of the year is divided among the member colleges.

Consumers acquires Michigan gas reserves

Consumers Power Co., Jackson, Mich., has added natural gas reserves to its system in such quantities that it seeks to connect 20,000 additional gas heating customers.

The company has purchased 38 gas wells in a natural gas field of approximately 6000 acres in Allegan county, Mich. The field will be connected with the company's system by construction of a 12-in. pipeline from the field to the Kalamazoo distribution area.

About 180,000 unfilled applications are on file with the company for heating service in the 286 Michigan communities it serves.

Underground site sought by Central Illinois

Leases on 7500 acres of land have been acquired by Central Illinois Light Co. The land, located southwest of Pekin, Ill., will be tested for an underground storage field.

Earl D. Edwards, Central Illinois president, said "Surface tests indicate a natural underground dome is in this area, and exploratory drilling will be conducted to define the extent and characteristics of the field in locating a tight dome that will successfully receive and hold natural gas."

Central Illinois Light hopes to augment sales and service facilities throughout its distribution systems, which center in the Peoria and Springfield area. Total gas sales are now at an annual rate of 23 billion cu ft, including service to about 68,000 heating customers.

New bulletin covers industrial ovens, dryers

Every phase of the installation and operation of industrial ovens and dryers is covered in a bulletin published by Factory Mutual En-

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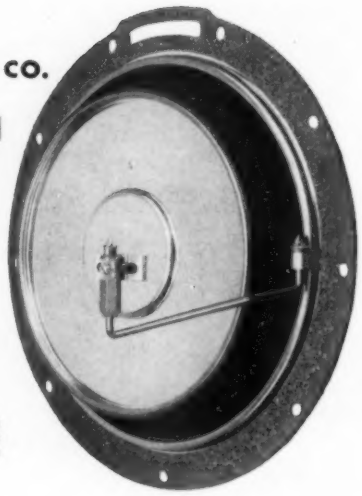

Lancaster S-700-L Synthetic Diaphragm

No other material tested has such flexibility and low differential! Lancaster diaphragm material and construction withstands excessive flexing — vital necessity for Sprague or Ironclad meters.

For the first time synthetic diaphragms can be perfectly centered and adjusted to thick or thin cases.

Adjustable carrier wire and special center bracket are attached to the Lancaster S-700-L Synthetic diaphragms . . . and there are no cloth linings to cause restrictions, leaks or breakdowns.

For Proper Meter Care Use These Lancaster Quality Products:

- Cork Gaskets
- Diaphragm Oil
- Dry Lubricant
- Glass Grinding Blocks, Abrasive Paper
- Index Stuffing Box Grease and Packing
- Index Box Cement
- Index Repair Bushings
- Neoprene Connection Washers
- Nylon Washers for Screws

S-700-L Synthetic Diaphragm comes complete with carrier wire and gasket attached. Can be furnished without gaskets cemented to flange.

Not recommended for manufactured gas.

"A Meter is only as Accurate as its Parts"

Lancaster METER PARTS CO.

Manufacturers of Quality Parts for Gas Meters

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gineering Division of the Associated Factory Mutual Fire Insurance Companies, Norwood, Mass.

Entitled, "Industrial Ovens and Dryers, Safe Installation and Operation," the bulletin is divided into seven parts. It includes the suggested procedures for oven manufacturers' application for acceptance by Factory Mutual; basic safety considerations for locations and construction of industrial ovens and dryers; sections on preventing fuel and vapor explosions; and a final part on the procedure to follow for safety tests on equipment and controls.

Southern Union boosts Albuquerque gas supply

Albuquerque (N.M.) is benefitting from an enlargement and replacement program launched by Southern Union Gas Co.

New lines from the Star Lake compressor station near the Continental Divide will extend 11.5 miles, and will cost an estimated $350,000 to $400,000. About three miles of 20-in. main will replace a 12-in. main, and plans also call for construction of an additional 8.5 miles of 20-in. mine from Santa Fe Junction toward the Kutz Canyon station.

Southern Union now serves almost 57,000 customers in its Albuquerque district.

Oil Heat Institute attacks Type B vents

Manufacturers and utilities are being alerted to a new anti-gas campaign launched by the distribution division of the Oil Heat Institute of America.

Target of this campaign is the Type B vent, and the OHI has put together a working kit to inspire ordinances requiring masonry or factory-built chimneys in all new homes and outlawing use of Type B vents.

The gas vent and chimney division of GAMA is backing its retort to the OHI with solid facts. Misstatement is backed by facts, such as: OHI claim— ". . . the several types of inexpensive single-fuel vents known as Type B vents that are installed as substitutes for safe all-purpose chimneys are a threat to public health, safety and security." The fact—Type B vents

the word is really getting around!

REPLACEMENT OR REFUND OF MONEY
Guaranteed by Good Housekeeping
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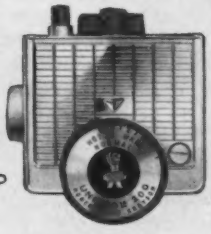
UNITROL 400

ROBERTSHAW-GRAYSON WATER HEATER CONTROLS now feature the GOOD HOUSEKEEPING GUARANTY SEAL!



UNITROL 200

UNITROL 110

Here's important news for your water heater customers... the Good Housekeeping Guaranty Seal on ROBERTSHAW-GRAYSON water heater controls! What buyer doesn't recognize this value immediately? Next month, ROBERTSHAW-GRAYSON will announce their new promotion with a colorful full page advertisement in Good Housekeeping magazine... read by more than 10½ million homemakers all over America. ROBERTSHAW-GRAYSON controls on the water heaters you sell will give them a great new mark of distinction.

Specify Robertshaw-Grayson Unitrols Today!

Robertshaw-Fulton CONTROLS COMPANY

GRAYSON CONTROLS DIVISION • LONG BEACH, CALIFORNIA

STOP H_2S CORROSION BEFORE IT STARTS!

The Connelly IRON SPONGE purification process at the well site removes hydrogen sulphide BEFORE the gas is piped to central processing. Thus, the cause of pipe line corrosion is eliminated because corrosive gas never enters the transmission lines. Additionally, Connelly IRON SPONGE eliminates the need for extreme close control. It operates with high efficiency at low or high pressures—absorbs more H_2S, gives longer service between foulings and is easily regenerated. If you have a purification problem check this MOST ECONOMICAL solution today. Write for Field Processing Bulletin #OG-7.

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are accepted by 10 national groups, together with federal, state, and municipal building regulations. OHI claim— ". . . Type B vents are not allowed to be used with heating plants in New York City . . . " The fact—New York has recognized the Type B vent as a safe and adequate means of venting, and has revised its regulations to permit the installation and use of Type B vents. OHI also erroneously lists Camden, N. J., Raleigh, N. C., and Memphis, Tenn., as banning these vents.

Dresser Manufacturing enters plastic field

Dresser Manufacturing Division has formed a plastic products department "to develop and market plastic products for the joining, repairing and maintenance of pipe." S. B. Hodges, marketing manager of the Bradford, Pa. company, will coordinate activities of the new department.

F. G. Fabian Jr., Dresser general manager, said, "We intend to go ahead with this program even though some of these products may displace products we now sell. For the past three years, we have been carrying forward an extensive program of research, both in our own laboratories and through outstanding research laboratories such as those at the Illinois Institute of Technology."

One line of plastic products, Epi-Seal by name, has already been offered by Dresser for a variety of pipe repair applications. Manufactured for Dresser by Bonded Products Inc., Epi-Seal products are epoxy resin compounds which are for the repair of underground pipe and joints.

Lake Erie gas deposit estimates raised

Estimates of the amount of gas deposited beneath the northern shores of Lake Erie are being revised upwards. Recent reports indicate the possibility of vast deposits as close to Buffalo as Fort Erie. The field is believed to extend from Fort Erie to Windsor, Ont., across from Detroit.

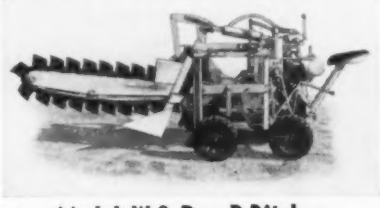
More than 1.5 million acres of underwater land are involved. Deepest water depths encountered so far are about 65 ft.

THERE'S **BIG PROFIT** IN DITCHING WITH A

Pow-R-Ditcher

Model 4T Pow-R-Ditcher

You'll **make** more money . . . you'll **save** more money when you dig with the rugged Vermeer 4T Pow-R-Ditcher. Just the machine for laying gas pipe, service lines and for digging foundation footings. Very maneuverable, the 4T Pow-R-Ditcher is only 48" wide, 6' high, 13' long. Digs 6" to 14" wide and can be transported in a pickup truck. A one man self-propelled unit. Thousands in use. The low price will amaze you!



Model W-2 Pow-R-Ditcher

The baby of the Vermeer line, the W-2 digs 2½" to 4" wide, 3' deep at 1' to 10' per minute. Fine for small trenches, for gas and electrical service and shallow water lines. Rugged, heavier-built, self powered and inexpensive.

Write for complete information, literature and low prices on the complete Vermeer Pow-R-Ditcher line . . . or see your nearest Vermeer dealer.

VERMEER MANUFACTURING CO.

1441 W. WASHINGTON • PELLA, IOWA

Ark-La to carry appliance accounts for retailers

Arkansas Louisiana Gas Co. has set up a new credit system to handle financing of installment purchases of appliances by customers in Arkansas, Louisiana, and Texas.

The new plan will be handled in cooperation with retailers. Sales will be made in the usual manner and, after checking the customer's credit rating, Ark-La will pick up the sales contract and bill the customer for his monthly installment along with his gas bill.

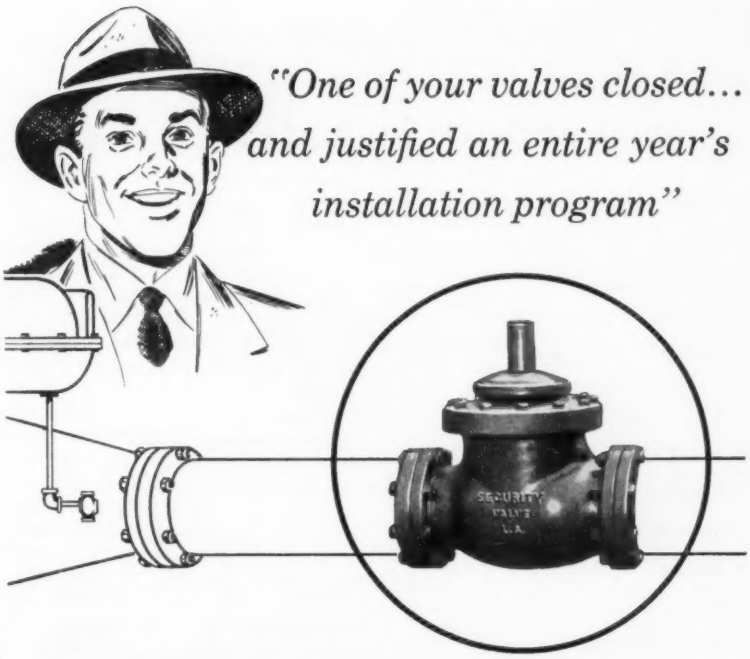
Ductile iron valves withstand fire test

A solution to the problems of fire and corrosion in piping systems may have been found in a new application of ductile iron.

Refinery engineers visiting the Boston Works of the Walworth Co. watched a demonstration in which a 6-in. ductile iron gate valve was heated to a red-hot temperature of 1350°F, and then suddenly water quenched. The valve retained its shape and dimensions.

The test approximated an actual refinery fire to include the types of stress to which valves are subjected in those conditions. Heavy weights on each end of the I beam supporting the valve simulated the external stress which expanding piping in a refinery fire would exert on a valve. Stress due to differences in expansion of the valve body from uneven heating was achieved by concentrating an oil fire and a gas flame on one side of the valve.

A Walworth research engineer explains thermal shock test setup of ductile iron valve to Marshall David of Boston Gas Co. The valve was mounted over a pool of oil and just off the nozzle of a gas line.

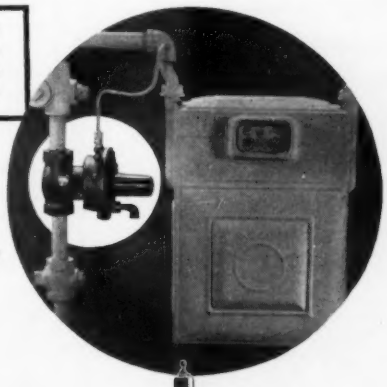


■ That's the experience of just one of the major gas companies and gas-using industries from coast to coast who have standardized on Security Automatic Shut-Off Valves. Because of their *absolute* protection against overpressuring, the operation of a single Security Valve can pay for a system-wide installation.

Security Valves are positive and always dependable . . . they are engineered for one specific function. Vital in congested areas, they eliminate both the expense and hazard created by high-capacity vent lines necessary when other over-pressure protection devices are employed.

A *complete* line, Security Automatic Shut-Off Valves are available in sizes ¾" to 12" for use on lines operating on inches water column to 1500 psig. They can be installed up or downstream of the regulator and controlled directly or by means of a pilot line.

Security Automatic Shut-Off Valves range from ¾" for domestic lines (right) to large distribution line sizes (above).



Nationwide representation insures fast help on your gas safety problems. Write today for the complete story and specifications of Security Valves.

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SECURITY VALVE CORP.

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- Plicoflex Tapes
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- Poly-Mastic Coating
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- Plico Casing Seals
- Cadweld Connections
- Magnesium Anodes
- Nylon Bushings—Couplings
- Fleetline Vents and Markers
- Saddles and Reducers
- Plidco Flanges
- Weld + Ends
- Smith + Clamps
- Kralastic Pipe and Fittings
- Holiday Detectors
- H & M Bevelling Machines
- Tongs—Dollies—Blocks
- Welding Clamps
- Slings and Fittings
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news • *Continued*

Four-year scholarships presented by Robertshaw

Five recent high school graduates entered college this fall as recipients of four-year scholarships awarded them by Robertshaw-Fulton Controls Co.

The five winners, chosen for their superior scholastic record, will study electrical and mechanical engineering at leading engineering colleges. To be eligible, candidates had to be residents of counties where Robertshaw has plants. The students also received cash awards.

Robertshaw established the program four years ago to encourage the study of engineering by young men. The awards, a company spokesman said, are made with no obligation on the part of the recipients to accept future employment with the company.

Sons of company officers are not eligible for the scholarships. But two of this year's winners are sons of company employees.

Ohio Fuel increasing supplies to Ohio towns

Work is under way on a $2 million pipeline construction project that will enable Ohio Fuel Gas Co. to increase gas deliveries to several northern Ohio communities.

Almost 30 miles of 24-in. line is being laid from Ohio Fuel's Pavonia compressor station in Richland county to near Attica in Seneca county. The new line is being laid parallel to an existing 20-incher and will be tied into the existing line near Attica.

GAS news notes

Pittsburgh Coke & Chemical Co. has bought assets of the Insul-Matic companies of Summit, Ill. The newly acquired facilities will continue production of the Insul-Matic line of asphaltic coatings and insulated materials.

Niagara-Mohawk Power Corp. is seeking franchises to serve gas in various townships and villages in St. Lawrence and Franklin counties, N. Y.

WARRENGAS the Concentrated Fuel

GULF GULFTANE LP-GAS BUTANE PROPANE

WARREN
PETROLEUM CORPORATION
LIQUEFIED PETROLEUM GAS DIVISION
TULSA, OKLAHOMA

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TAMPA, FLORIDA
SAN FRANCISCO, CALIFORNIA
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Gas Systems made safer with

GAS LEAKAGE SURVEYS
#1. Vegetation
#2. Safety
#3. Combination

SOUTHERN CROSS FORESTERS
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MElrose 4-4227
Let us account for your "Unaccounted-for"

Gas Purifying Materials Co. Inc., Long Island City, N. Y., is distributing Nervatape polyethylene and vinyl pressure sensitive tapes in New England and New York. Manufacturer of the wrapping and insulating materials is Rubber & Plastics Compound Co., New York.

Students from 35 engineering colleges have been invited to attend the Oct. 2-4 meeting of the NACE's north central region to be held at the Hotel Sherman in Chicago.

Tamco Corp. has shipped the first carload of Clipper forced air gas furnaces from its Sebastopol, Calif. plant. Under its new owner, Tamco, the Clipper furnace line has been expanded to include both vertical and horizontal forced air units, as well as the Barnes line of floor and dual wall furnaces.

Gas Service Co.'s purchase of central West Utility Co. properties in Missouri has been approved by directors of Gas Service. The property involved serves 4300 customers in Liberty, Smithville, and part of Gladstone. Gas Service serves greater Kansas City.

Good-All Electric Manufacturing Co., Ogallala, Neb., has named Colby Inc., Houston, export agent for the rectifier section of the Electrical Mechanical division. Colby will cover every place but Venezuela, Canada, Alaska, and Hawaii.

Three new distributors have been appointed by the Polyken Sales division of the Kendall Co. They are: Donald Corp., Des Moines, Iowa; Shutt Process Equipment Corp., St. Louis; and Simcoe Equipment Co., Minneapolis.

Swenson-Maurer & Associates are new sales representatives for the U-brand pipe fittings of Union Malleable Manufacturing Co. Swenson-Maurer's territory covers the greater New York area, New Jersey, and lower Connecticut.

United Gas & Fuel Co. has started the million-dollar conversion of appliances and equipment to natural gas in Hamilton, Ont. Thirty-five hundred families are involved in the first stages of conversion along with a few factories, including a Westinghouse plant. Winter will halt the changeover after the first two sections have been taken care of.

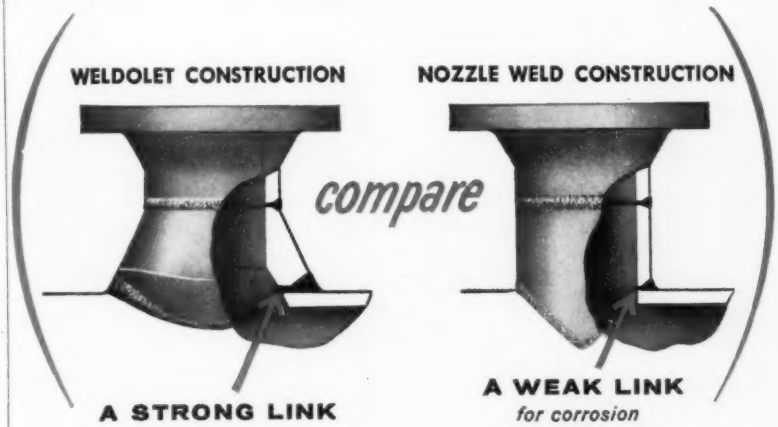
years to your piping

gallons to your flow

strength to an otherwise weak link

add → **BONNEY WELDOLETS**

to your piping drawings for all branch connections



Labor costs are now at an all time high. Reevaluation of your piping costs will now reveal Weldolets 4" and smaller to be less costly to fabricate than unreinforced nozzle connections. In the field this is also true of larger sizes and Weldolets are always more economical than branch connections made by welding tees or reinforced nozzles. Weldolets are manufactured in all sizes from 36" and all weights from xxs, in carbon steel, stainless, alloy, wrought iron and non-ferrous metals.

BONNEY

WELDOLETS ®

THREDOLETS ®

SOCKOLETS ®

PENNSYLVANIA DIVISION

BONNEY FORGE & TOOL WORKS

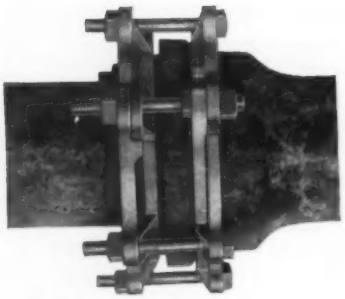
ALLENTOWN, PENNSYLVANIA DEPT. B

Gas Digest

A digest of what's new in products and trade literature compiled by the editors of GAS as a reader service.

New Products and Trade Literature

For more data on any of these items use the Readers' Service Card on pages 115, 116

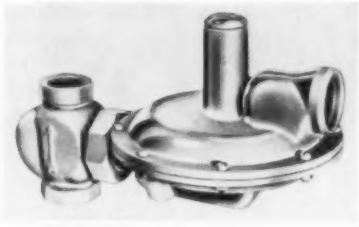


1. Bell joint clamp

Joslyn's line of bell joint clamps ranges in sizes from 4 in. through 30 in. The clamps consist of two segmental, malleable iron rings, a combination single ring gasket made of two hardnesses of rubber, and a set of clamping bolts. The soft rubber portion of the gasket quickly seals off the leak in the bell and spigot joint. The harder outer portion of the gasket resists cold flow and holds the gasket under permanent pressure.
Joslyn Mfg. & Supply Co.

2. Thawing heater

Perfection Industries has announced a new heating method capable of thawing a rail car filled with frozen iron ore in minutes. Infrared rays produced by a gas infrared generator are used. An operating temperature of 1650°F is achieved in the Perfection Schwank generator by burning gas on the surface of a patented ceramic mat. Gas is converted into infrared energy in wave lengths readily absorbed by most materials in every-day use.
Perfection Industries



3. Relief regulator

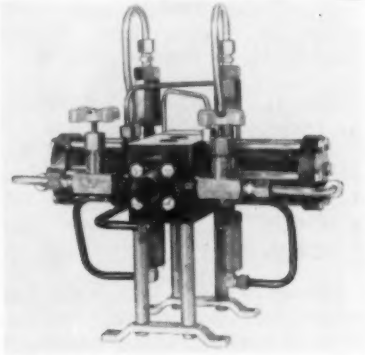
An internal mechanical relief valve capable of venting full line capacity should failure occur is featured in American Meter Co.'s new series of domestic service regulators. Reliance Series 1413-A regulators are designed for ease of installation — indoors and out — and provide maximum safety under the most severe conditions.
American Meter Co.

4. Pressure controller

Barton Instrument's Model 237 differential pressure controller features the Barton Model 199 rupture-proof bellows unit. It is furnished in differential pressure ranges from 0-20 in. w.c. to 0-50 psi with static pressure ratings up to 6000 psi. Housings include aluminum, steel, alloy steel, and stainless steel. Standard control actions include on-off, differential gap, and proportional.
Barton Instrument Corp.

5. Joint wrap

L-O-F Glass Fibers is making available a new strong glass fabric base pipeline joint wrap. Known as Duratape, the wrap features tensile strength in both longitudinal and horizontal directions. It is highly resistant to electrolytic currents and is designed for hand wrapping of field joints and fittings on underground pipelines.
L-O-F Glass Fibers Co.



6. Glycol pump

A double-acting glycol pump from Kimray reportedly eliminates high-pressure liquid-level controls on the absorber of glycol-type gas dehydrators. Available with a working pressure of 1500 psi and

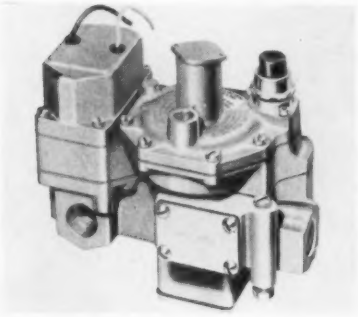
capacities from 40 to 450 gal./hr, the pump has only two moving assemblies and forms a completely closed system.

Kimray Inc.

7. Safety valves

A new series of top-guided, semi-nozzle cast iron safety valves is announced by Farris Engineering. The new Farris 1900 and 2900 Series valves offer a maximum pressure of 250 psig at 450°F. These "Super Capacity" safety valves are being offered with a full selection of nozzle and flange sizes: 21 nozzle sizes and seven body sizes. Hardened stainless discs and two-point, extra-long guiding are featured.

Farris Engineering Corp.



8. Furnace control

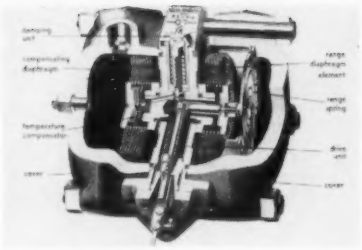
Silent operation, 100 per cent safe lighting, and 100 per cent shutoff are featured in A-P Controls Model 5250 control for large Btu capacity furnaces. It has a built-in pressure regulator and offers a choice of three outlets: right hand, left hand, or straight-through. The control also features electro-magnetic thermostatic operator, flow interruptor with summer shutdown, and thermomagnetic safety pilot.

A-P Controls

9. Heating unit

A new heating unit from Gas Appliance Service is said to be well adapted to the debonding (or normalizing) and blueing of rotors used in electric motors. The unit heats the periphery of the rotor to approximately 900°F to separate the die-cast aluminum from the steel laminations, which increases operating efficiency of the motor. Heating time is 3 to 4 minutes for a 4-in. rotor. Production is from 350 to 400 units per hour.

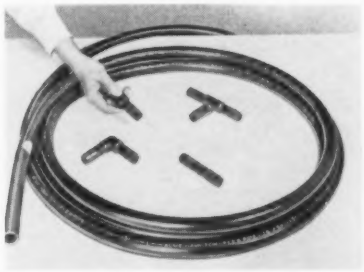
Gas Appliance Service Inc.



10. Diaphragm meter

Preformed, highly sensitive diaphragms are stacked to nest together for positive over-range protection to full static pressure in Foxboro's Type 37 diaphragm meter. The meter is designed for accurate flow measurement, and presents a new concept in mercuryless meter design. Differential ranges are 0-20, 0-50, 0-100, and 0-200 in. of water.

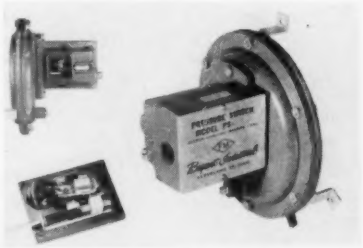
Foxboro Co.



11. Plastic pipe, fittings

A complete line of flexible, lightweight, non-corrosive plastic pipe and fittings is available from Acme Rubber. With the use of insert-type fittings and clamps, this plastic pipe simplifies many difficult and costly piping installations. Pipe sizes range from ½-in. through 3-in., for pressure ratings from 55 to 100 psi. A wide variety of polyethylene fittings and metal clamps also is in production.

Acme Rubber Mfg. Co.



12. Pressure switch

Bryant Industrial's new pneumatic pressure switch is adaptable to many control and safety functions and may be used to prove the presence or absence of pressure, vacuum or flow of air and inert or combustible gases. The unit closes a 1200-watt circuit under preselected pressure, suction, or the differential sum of two pressures over a range of from 0.1-in. w.c. to 1 psi.

Bryant Industrial Products

13. Commercial heater

Copper-nickel alloy tank is featured in Ruud's new commercial automatic gas water heater. The copper nickel Sanimaster can be installed singly or in multiples for single or two-temperature operation. Model CST 80-80 has AGA approval as an automatic storage water heater and as a circulating tank water heater. Both 140° and 180° "sanitizing" hot water for dishwashing can be furnished from the single copper-nickel tank.

Ruud Manufacturing Co.

14. Appliance regulator

Maxitrol's new appliance gas regulator for main burner and pilot loads is designed to fit into small areas. The RV-30 is of tamper-proof construction (hermetic type) and cannot be field disassembled. Because of the precision synthetic rubber valve seat, the new regulator maintains accurate regulation at the extremely low flow rates encountered with tiny pilot flames.

Maxitrol Co.

15. Radiant heater

Carrier Corp.'s new Mobileray is a radiant heater designed for small coaches and travel trailers. It is being produced in two models for floor mounting or wall installation. Both are available with manual or automatic controls and can operate on natural or LP gas. The wall-type gives up to 30,000 Btu while the Mobileray floor design has capacities up to 16,500 Btu.

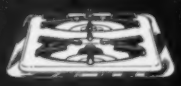
Carrier Corp.

Full-Size 36" Model. Striking range with new, advanced luxury features available.

Space-Saving 30" Model. Boasts mammoth 24" oven, beautiful AstraGlo backguard.

20" Apartment Model. Now with high-style design, AstraGlo backguard.

Fabulous New Hardwick Built-Ins. Oven and counter-top units outstanding for popular price, ease of installation, beautiful appearance. White, Coppertone or Stainless finish.



HARDWICK'S TOP PERFORMANCE

EARNS

THIS FAMOUS TAG

USE-TESTED by McCall's

HARDWICK AUTOMATIC GAS RANGE

"we used it and we like it!"

This tag of approval is one of America's most powerful selling aids. Your customers are among McCall's 4½ million subscribers and with McCall's telling your Hardwick story first, your selling is simpler and more effective. Display Hardwick models with this "Use-Tested" tag attached and see for yourself.

Hardwick ranges offer cooking performance, prices and convenience features that top them all. Features like EconoMatic oven lighting, EconoTrol top burners, EquaFlo oven burners and the amazing new Thermal Eye top burner control. Display Hardwick models in all sizes and types and see for yourself how Hardwick's beauty, top performance and popular price help you sell more ranges.

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McCall's
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See HARDWICK for '57

HARDWICK STOVE COMPANY, CLEVELAND, TENN.

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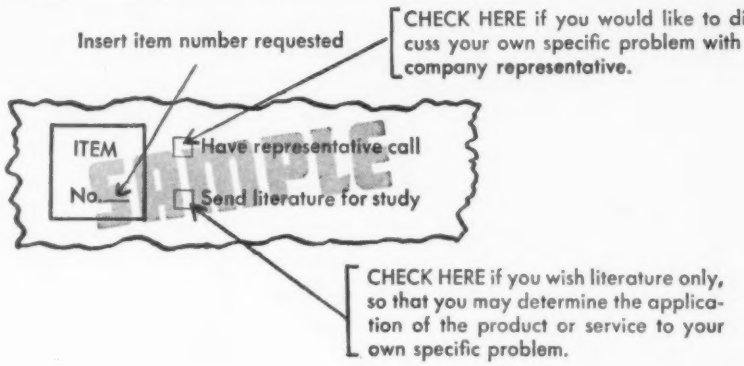
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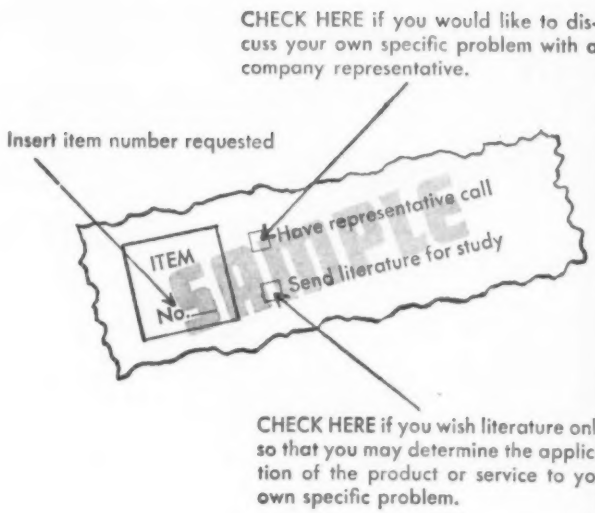
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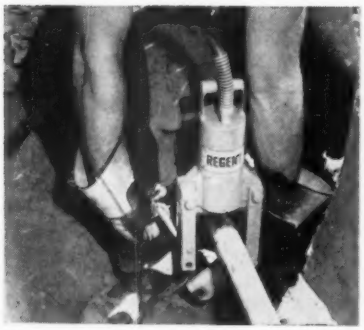


16. Pipe squeezer

Regent Jack Manufacturing Co. has developed a tool for quick, simplified gas line repairs and maintenance. Called the Regent flow-stop pipe squeezer, the tool consists of a hydraulically operated ram and a pair of jaws that clamp around the pipe. Pressure of the ram against the jaws compresses the pipe until the flow is shut off.
Regent Jack Mfg. Co.

17. Vent pipe

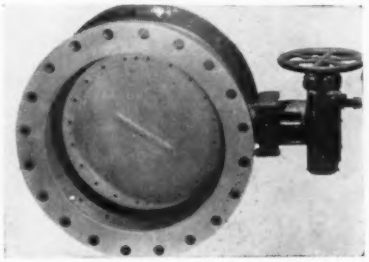
Dura-Vent is making available a complete line of double-wall gas-vent pipe in large sizes. This includes four sizes of the metal-wall, air-insulated round pipe and fittings—7, 8, 10, and 12 in. in inside diameter. A noteworthy feature of all units in the line is the single-piece construction of the outer wall.
Dura-Vent Corp.

18. Testing instrument

Areas of corrosion or wear on pipes, storage tanks, and other structures and products accessible from one side only are located by a new measuring instrument from Magnaflux. The completely portable, battery-operated ultrasonic thickness measuring unit is designated Sonizon SO-200. The operator selects the proper crystal range, places the probe on the test area and rotates the circular read-out dial until the harmonic lines match a pattern of flashing lights. He then reads thickness directly from the dial.
Magnaflux Corp.

19. Automatic furnace

High speed heating of die-cast fractional horsepower motor rotors is practical and safe with a new Gradiation furnace developed by Selas. The furnace is capable of heating up to 400 motor rotors per hour to a temperature of 1000°F for shrink fittings of rotor shafts, blueing the outer surface of the turned laminations, and simultaneously developing improved electrical and torque characteristics.
Selas Corp.

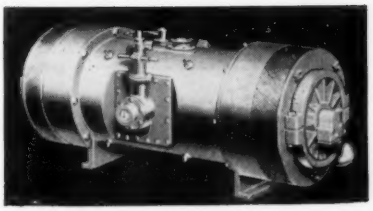


20. Butterfly valve

A new rubber seating principle and unusual operating characteristics are featured in Darling Valve's recently introduced line of butterfly valves. Advantages claimed: lower operating torque, adjustability of seat for tight shutoff, seat replacement without removal of shaft or operator, elimination of shaft sealing problems, and increased operating cycles.
Darling Valve & Mfg. Co.

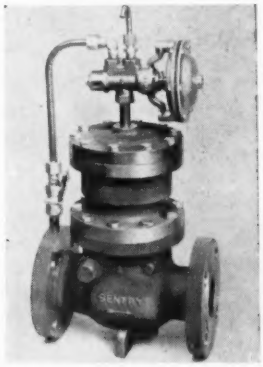
21. Street-box housing

Mesh-reinforced concrete is used in Geo. P. Forni's new street box housing for gas plug valves. A centrifugally cast duraluminum ring holds the cast iron cover so it will not cause sparks. It will not rust together and is always easily removed. Since the box telescopes over the extension grade adjustment is simple. A ring at the top locks with the road surface so that the box is always flush with the top of the paving.
Geo. P. Forni Co., Inc.



22. Turbocharged engine

Baldwin-Lima-Hamilton has announced a new engine design. The free piston engine produces pneumatic power. The pistons, free to bounce in their cylinders, are restricted by the cylinders but not by the linkage through connecting rods for a crankshaft. Power output of the prototype design ranges from 125 shaft hp up to 1000 shaft hp.
Baldwin-Lima-Hamilton.



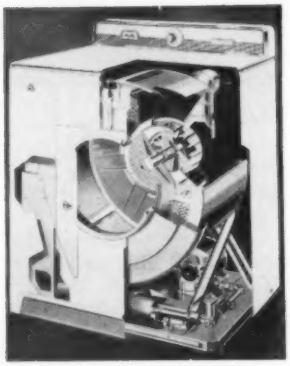
23. Piston-type valve

Two Sentry valves are announced by Coppus Engineering. The Sentry piston-type is for automatic opening and closing of gas lines. It opens instantly with the line flow when the pressure in the piston chamber is released. The Sentry latch-type valves for instant, split second closing of gas and fuel lines are actuated on predetermined high pressures, low pressures, excess flow, excess temperatures, or electrically by use of a solenoid.
Coppus Engineering Corp.

24. Water heaters

Cleveland Heater's new Rex Victor line of automatic gas water heaters is available in two sizes—30- and 40-gal.—with choice of galvanized or glass-lined tank. The Victor has full insulation, copper-bearing steel tank, electrically welded and pressure tested, stainless steel pilot burner.
Cleveland Heater Co.

GAS Digest • *Cont'd.*



25. Gas dryer

Several outstanding features are incorporated in Maytag's new "halo of heat" automatic gas dryer. It offers completely uniform heat distribution, disc-type lint filter that revolves with the drum to filter 100 per cent of the drying air, and single-mount construction.
Maytag Co.

TRADE LITERATURE

26. Loader

Joost Manufacturing Co.'s new, improved Agricat loader, which is equipped with an hydraulically operated bucket tilt mechanism, is described in a new catalog. The Model F may be quickly converted from a loader into a light earthmover by replacing the bucket with a blade attachment.
Joost Manufacturing Co.

27. Measuring wheel

Rolatape measuring wheel Model 400 is the subject of a new piece of literature. Described is the precision calibrated wheel, which measures distances from zero up to nearly 19 miles.
Rolatape, Inc.

28. Ladder-type ditcher

A new catalog describes the Gar Wood-Buckeye 403 service line and house foundation ladder-type ditcher. The eight-page publication features in-the-field photos, detailed information, and specifications.
Gar Wood Industries, Inc.

29. Wellhead dehydrators

"A new concept in dehydration" is presented in a brochure from Fish Engineering. Described is a dehydrator in which calcium chloride pellets are used in a tower designed to give unusually high dehydration efficiency with maximum safety.
Fish Engineering Corp.

30. Instrumentation

"Tech-Talk" is the title of a new Schlumberger publication which will be published periodically to describe new developments in specialized instrumentation. The first issue deals with a new tool for moisture analysis, the Schlumberger nuclear magnetic resonance analyzer.
Schlumberger Well Surveying Corp.

31. Data processing

Beckman Instruments Model 112 data processing system is the subject of a new eight-page brochure. Detail is given outlining the economics of automatic data processing in today's well instrumentated plant.
Beckman Instruments Inc.

32. Truck bodies

Auto Body Works has issued a new catalog describing its line of general service utility truck bodies. Five models in the SM series are pictured, together with specifications.
Auto Body Works, Inc.

33. Pipeline design

As an example of a Datatron computational process, ElectroData has published an eight-page brochure describing the optimum design of a natural gas pipeline. The brochure describes how the computer completes—in 1.4 seconds—the calculations involving one pipe segment or compressor station design.
ElectroData Division.

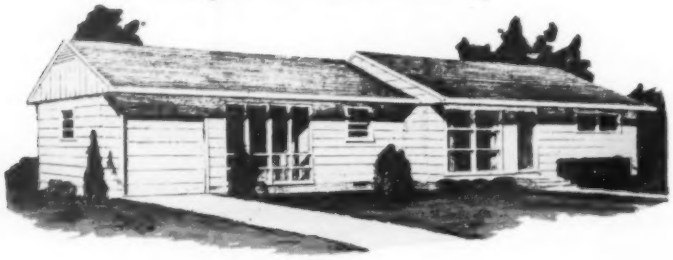
34. Air-operated valves

Conoflow's air-operated Saunders valves are the subject of an eight-page, illustrated booklet. Construction details and operating characteristics of Series HB Saunders valves are presented.
Conoflow Corp.

35. Regulator repair

Available from Universal Controls is a bulletin explaining the method of operating Universal reg-

Another SOUTHERN MILL Prefabricated Home
Designed for Gracious Living



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This home is made up of standard STURDYBILT sections, prefabricated at the factory. With the breezeway, utility and comfort is added. STURDYBILT Prefabricated homes with a luxury look can be economically erected on your site. Write for information.

STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

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STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

ulator repair and test stand and meter repair racks. Complete operation instructions as well as time and labor saving suggestions in testing and repairing regulators and meters are contained.
Universal Controls Corp.

36. Plastic pipe

Regular and high impact corrosion-resistant rigid polyvinyl chloride pipe is the subject of a 12-page, two-color catalog from Alpha Plastics. Included are tables of pipe sizes, applications, properties, temperature factors, and flow charts.
Alpha Plastics, Inc.

37. Heavy-duty thermostat

Bulletin RT-815 from Robertshaw describes a heavy duty, high capacity gas thermostat for use in commercial and industrial equipment. Model CTS is of the snap-acting type and is available in temperature ranges to 550°F.
Robertshaw-Fulton Controls Co.

38. Btu meter

Heat in thermal units and liquid flow in gallons can be measured by a completely mechanical instrument described in a new bulletin.
Air Conditioning Equipment Corp.

39. Dust control

Operation of American Air Filter's dust collector, the Type W Roto-Clone, is covered in a new product bulletin. The bulletin explains the Type W's distinguishing feature—the addition of a water spray to the basic principle of dynamic precipitation.
American Air Filter Co.

40. Gas detector

Descriptive literature has been published on Johnson-Williams Gas-Pointer. This is a portable unit for detecting and measuring natural gas concentrations in two ranges, 0-1.0 l.e.l (lower explosive limit), and 0-100 per cent actual gas concentration.
Johnson-Williams, Inc.

41. Computer

Literature on its III-E computer has been published by Alwac Corp. This data processing system is now available with automatic high speed card converter, which is described along with the entire system.
Alwac Corp.

Testing borhole for gas leakage

pin-point gas leaks quickly . . . accurately with

dual-range **J-W "GAS-POINTER"**

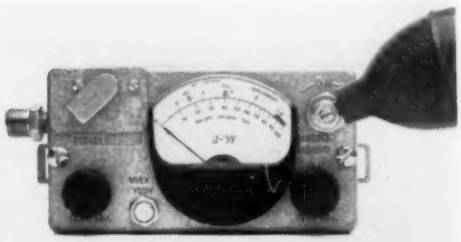
J-W GAS-POINTER Model H

GAS-POINTER locates leaks in buried pipelines and provides readings in 2 ranges—0-1.0 l.e.l. (lower explosive limit) and 0-100% for direct reading of actual gas concentration. The unit is useful also for testing manholes and valve boxes and as a general purpose indicator.

Exclusive design features permit range changes without electrical switching or zero change—and without addition of dilution air.

Weight of the unit is 5 lbs. Special calibrations for mixed gases or propane air available on special order. The standard unit with accessories is priced under 150.00. Complete descriptive literature sent on your request.

Readings are made from this easy-to-understand meter dial. Two-position valve is shown at upper left. The soft rubber bulb draws the sample and is rotated to actuate on-off switch. No special training is required.



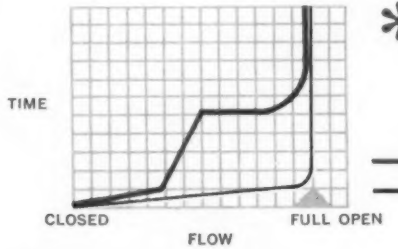
J-W

JOHNSON-WILLIAMS, INC.
PALO ALTO, CALIFORNIA
30 years of leadership in explosion prevention

Canadian customers please write: **SAFETY SUPPLY CO.** TORONTO, ONT. **FLECK BROS. LTD.** VANCOUVER, B. C.

INTRODUCING the K-3H* HYDRANOID VALVE with DIAL-A-FLO – the greatest advance in controlled gas flow since the B-60 self-powered system.

DIAL-A-FLO is the adjustable feature that step-opens main line gas flow...tailors K-3H electric valve performance to exact heating equipment requirements.



* K-3H Hydranoid gas valve is the only all quiet electric valve with sealed operator containing silicone fluid . . . for **controlled** mechanical motion. Available in combination models, too.

K-3H DIAL-A-FLO

STANDARD ELECTRIC VALVE

GENERAL CONTROLS

America's Finest Automatic Controls for Home, Industry, and the Military

Glendale, California • Skokie, Illinois • Guelph, Ontario, Canada

Five Plants—42 factory branch offices serving the United States and Canada

GAS

associations

Safety honors to AGA—3rd time in 5 years

For the third time in five years the American Gas Association has been singled out by the National Safety Council's association safety award. Presentation of the award will be during the National Safety Congress in Chicago on Oct. 23.

In 1956 the gas industry improved its safety record for the ninth straight year. Increased emphasis on comprehensive safety programs has resulted in a 39.7 per cent reduction in AGA member companies' injury rates in the past five years and a 14.7 per cent improvement in the past year alone. An all-time low of 8.68 disabling injuries per million manhours was achieved last year.

Sales, promotion, PR session set for Canadians

Sales, promotion, and public relations are the topics for discussion at one of the most ambitious conferences yet scheduled by the Canadian Gas Association. The workshop will be held in the Macdonald hotel in Edmonton on Oct. 24-25.

Two active CGA groups—sales and promotion committee and the PR committee—are joining forces to prepare the session.

GAMA elects new member companies

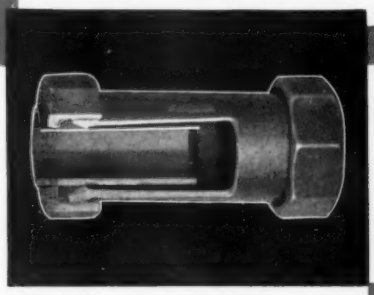
Several new companies have been elected to membership in the Gas Appliance Manufacturers Association.

They are Franklin Lumber & Fixture Co., Columbus, Ohio, manufacturer of dry-heated hot food tables for hotel, restaurant and commercial use; Rosander Co., Minneapolis, producer of gas commercial coffee makers; and Lucas-Rotax, Toronto, Canada, manufacturer of gas hot water heating boilers and warm air furnaces.

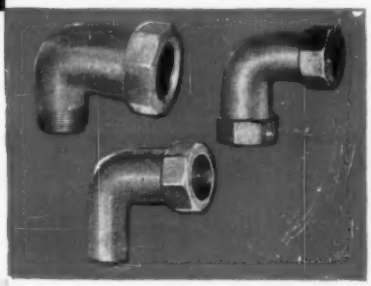
NORMAC

Couplings, Sleeves and Fittings for ☆ UNIFORMITY ☆ DEPENDABILITY ☆ ADAPTABILITY

Normac gas distribution products are engineered and manufactured to meet every requirement of modern gas distribution. Write today for catalog.

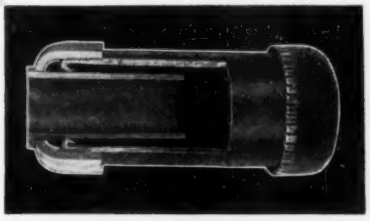


NORMAC COUPLINGS
Normac malleable couplings and sleeves offer the ultimate in deflection and strength with a center wall thickness greater than the wall thickness of the service pipe on which they are used. Every Normac fitting is individually air tested.



COMPRESSION-END "ELLS"
Normac ells of all types incorporate every feature of the Normac coupling plus full coupling depth.

COMPRESSION-END SERVICE "TEE"
Full coupling depth. Special threads on male end prevent dropping into old hand taps.



NORMAC #50-A STEEL COUPLINGS
Manufactured from extra heavy wall pipe. Couplings are available with either seamless or welded centers in sizes from ¾" to 1½" inclusive. 10" and special length centers available.

Normac also manufactures a complete line of red brass fittings in O. D. sizes: ⅝", ⅞", 1⅛", 1⅜"—and a complete line of insulated couplings and fittings.

NORTON-McMURRAY MFG. CO.

919 North Michigan Avenue — Chicago 11, Illinois

BORE with HYDRAUGER

(EARTH BORING MACHINE)

Designed for maximum control of the reamer. Earth along the pilot bits acts as a bearing to steady the reamer assuring an accurate hole.

FREE BOOKLET.. SEND COUPON BELOW

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HYDRAUGER CORP., LTD. 681 MARKET ST. SAN FRANCISCO

Please send, without obligation to me, the HYDRAUGER BOOKLET which shows relative costs and speeds of BORING as well as specifications of various Hydrauger models.

NAME _____ ADDRESS _____

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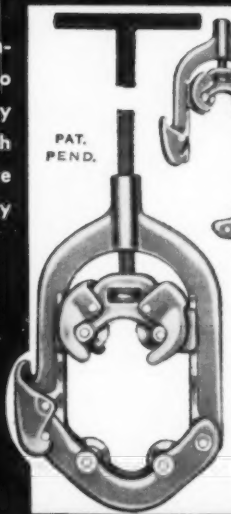
IF YOU CUT LARGE DIAMETER PIPE... YOU NEED THESE

New REED HINGED 4-WHEEL PIPE CUTTERS

Four sizes cover the range from 2½" to 12"

Users tell us these completely new cutters are so efficient they often "pay for themselves" through the savings in crew time on a half-dozen cuts. They are the first really practical tools for cutting off steel or cast iron pipe in sizes from 2½" to 12". You can, for example, cut 8" steel pipe completely off in less than five minutes.



Four wheel design requires minimum swing of handle—less digging in ditch work, easier "tight-corner" cuts.

Closed frame permits light weight with complete rigidity for better cutting.

4-point guide aligns the cutter on the pipe . . . assures perfect tracking and a right angle cut.

Reed Razor Blade wheels track perfectly, cut easily and roll down burr on steel pipe.

Unconditionally guaranteed to be the most efficient cutter you have ever used. Ask your jobber or write for literature.

REED MANUFACTURING COMPANY

ERIE, PENNSYLVANIA • U. S. A.

GAS calendar

October

1- 2. Texas Mid-Continent Oil & Gas Association 38th Annual Meeting—Texas Hotel, Fort Worth.

7- 9. AGA Annual Convention—Kiel Auditorium, St. Louis, Mo.

10-11. California Natural Gasoline Association Annual Fall Meeting—Huntington-Sheraton Hotel, Pasadena.

15-16. Fifth Gas Measurement Institute (sponsored by University of Kansas and Southwest Kansas Petroleum Institute)—American Legion Hall, Liberal, Kan.

16-18. Wisconsin Utilities Association Gas & Electric Operation and Sales Sections Convention—Schroeder Hotel, Milwaukee.

18. Southern Gas Association Transmission Sales Roundtable Conference—Captain Shreve Hotel, Shreveport.

21-25. National Safety Council—Conrad Hilton Hotel, Chicago.

23. NEGA Accounting Division—Sheraton-Biltmore, Providence.

25. Southern Gas Association Right-of-Way Roundtable Conference—Lamar Hotel, Houston.

25. Southern Gas Association Measurement Superintendent's Roundtable Conference—Lamar Hotel, Houston.

November

1. AGA Midwest Gas Association Public Relations Workshop—Nicolet Hotel, Minneapolis.

6. NEGA Operating Division—Hotel Statler, Hartford, Conn.

11-14. American Petroleum Institute—Conrad Hilton Hotel, Chicago.

13-15. ASA 8th National Conference on Standards and 39th Annual Meeting—San Francisco.

14-16. American Society of Refrigerating Engineers Semi-Annual Meeting—Shoreland Hotel, Chicago.

18-19. SGA Annual Advisory Council & Management Conference—Point Clear, Ala.

18-22. National Warm Air Heating & Air Conditioning Association—Hotel Morrison, Chicago.

December

1- 6. AGA-EEI Electronic Accounting Machine Development Seminar—Sheraton Cadillac Hotel, Detroit.

1- 6. American Society of Mechanical Engineers Annual Meeting—Hotel Statler, New York.

1958

January

6- 8. AGA Home Service Workshop—Hotel Radisson, Minneapolis.

23. NEGA Operating Division—Hotel Statler, Boston.

30. New England Gas Association Accounting Division—Hotel Statler, Boston.

February

20-21. SGA Distribution Management Roundtable Conference—Roosevelt Hotel, New Orleans.

March

17-21. National Association of Corrosion Engineers—San Francisco.

20-21. New England Gas Association Annual Meeting—Hotel Statler, Boston.

24-26. Mid-West Gas Association—Broadmoor Hotel, Colorado Springs.

27-28. Oklahoma Utilities Association Annual Convention—Biltmore Hotel, Oklahoma City.

31-April 2. GAMA Annual Meeting—The Greenbrier, White Sulphur Springs, W. Va.

31-April 2. AGA General Management Section Conference—Washington, D. C.

April

8-10. AGA Sales Conference on Industrial & Commercial Gas—Hotel Schroeder, Milwaukee.

14-16. National Conference of Electric & Gas Utility Accountants—Shamrock-Hilton Hotel, Houston.

15-17. Southwestern Gas Measurement Short Course—University of Oklahoma, North Campus, Norman.

28-30. Southern Gas Association Annual Convention—Dallas.

May

5- 9. AGA Distribution, Production, and Transmission Conference—Roosevelt and Commodore Hotels, New York.

12-19. AGA Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.

22-24. Pennsylvania Gas Association Annual Meeting—Pocono Manor Inn, Pocono Manor, Pa.

June

21-22. Michigan Gas Association—Grand Hotel, Mackinac Island, Mich.

24-27. Canadian Gas Association Annual Meeting—Manoir Richelieu Hotel, Murray Bay, Quebec.

COVER MORE GROUND—MOVE MORE DIRT with Bucyrus-Erie HYDROHOE

The outstanding, light-truck mobility of the Bucyrus-Erie Hydrohoe expands your territory . . . lets you handle scattered leak repair and other digging and lifting jobs with hydraulic *precision* and *power*.

Trench for mains or service connections; dig inspection, valve or anode pits; handle a variety of scattered, short-term gas utility jobs in the same day! The Hydrohoe wastes less time covering ground *between* jobs — more time moving dirt *on the job*. Its standard (new or used) commercial truck mounting makes the Hydrohoe fast on the highways . . . maneuverable in traffic. Shortest tail swing in the industry for its size lets you work on busy streets without blocking traffic.

A choice of standard, narrow or wide wrist-action dippers — or the specially designed utilities dipper — give you the most effective tool for every job. The utility dipper rotates 110 degrees at the handle to dig short, deep holes quickly. With it you cut corners square, even undercut sides of the pit.

Your Bucyrus-Erie Hydrocrane distributor will document the Hydrohoe's success story in gas utility work. Call him today.

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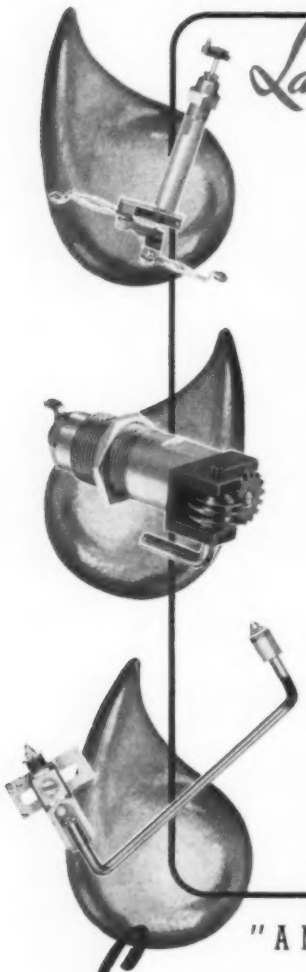

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MAIN MOVEMENT, INDEX DRIVE AND CARRIER WIRE ASSEMBLIES FOR 1-A SPRAGUE METERS

All moving parts in the Lancaster Main Movement, Index Drive and Carrier Wire assemblies operate in oil bearing metals. The oil-bearing surface of the Main Movement is greater than competitive assemblies by 30% in the Upper Main Movement, and by 126% in the diaphragm linkage.

- Once installed and adjusted, Lancaster parts need not be disturbed for oiling or greasing.
- The accurate performance of Lancaster parts is never restricted by excess oil or grease becoming stiff or sticky in cold weather.

Lancaster parts are made of hard metals—steel, bronze and brass; last life of meter. They're easy to install and adjust to unexcelled accuracy. For accuracy that lasts . . . order Lancaster Main Movements, and Index Drive assemblies and Diaphragms with built-in adjustable Carrier Wire Assemblies for your 1-A Sprague Gas Meters.

"A Meter is only as accurate as its Parts"

Lancaster METER PARTS CO.

Manufacturers of Quality Parts for Gas Meters

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Dielectric Couplings and Unions

Straight Couplings

MAYCO Dielectric Fittings are fitted with tough nylon Mayco Bushings able to withstand 230° F. and pressures up to 1000 lbs. They've been proven by thousands of mechanics and manufacturers who have used millions. Protection is positive . . . price is low enough to warrant use whenever dissimilar metals are joined. Ask your jobber.

Solder Unions

MAY COMPANY Galesburg, Illinois

Makers of Famous Mayco Dielectric Bushings

GAS people

JOHN T. BILLS has been elected vice president of Peoples Gas System of Florida. He will fill a new executive post, vice president-corporate-relations. Mr. Bills established his own firm of business and public relations consultants last October. Peoples Gas System has been one of his clients since that time.

The New York and Boston branch offices of General Controls, Glendale, Calif., have undergone a change in personnel. DICK GALLAGHER, formerly branch manager at Boston, has been promoted to assistant branch manager of the New York office. He is succeeded by JOHN BOYLE at Boston.

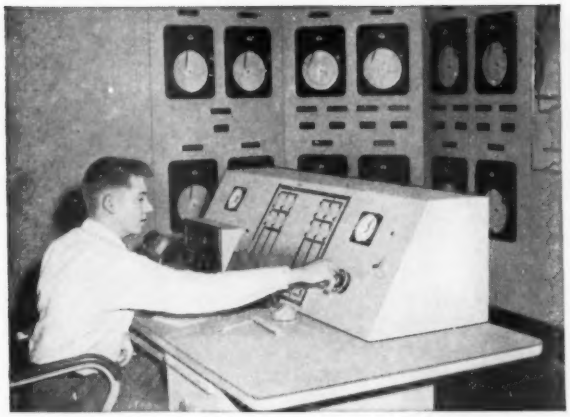
North Shore Gas Co., Waukegan, Ill., has added BUD CONWAY to its staff as dealer sales representative, a newly created post.

JOHN H. KIME has transferred from United Fuel Gas Co. to Preston Oil Co., Columbus, Ohio, as vice president. At United Fuel, Mr. Kime was superintendent of the production and storage department. Both UFG and Preston are operating companies of the Columbia Gas System.

FRANK L. GRIFFITH and KARL B. NAGLER have been elected to the newly created post of senior vice presidents of the Peoples Gas Light & Coke Co., Chicago. Griffith and Nagler have been vice presidents in charge of accounts and operations, respectively for many years. In other action by the board of directors, LESLIE A. BRANDT, a vice president, was elected to the additional office of comptroller; STUART J. BARRETT, formerly assistant vice president and assistant comptroller, was

Bud Conway
North Shore

John H. Kime
United Fuel



ONE man does the work of many...with AMERICAN® telemetering-telecounting equipment

In the largest gathering fields, along the pipelines, in large and small distribution systems, American telemetering and telecounting equipment substantially reduces personnel required for transmission of meter readings. From a central dispatching station, one man instantly obtains accurate flow and pressure readings at remote points and adjusts for load demands with remote-set controllers.

Your American representative can help you benefit by telemetering and telecounting all or any part of your system—large or small.

For Base Volume Indexes— American Telecounters accurately transmit Base Volume Index indications of gas quantities computed to base temperature and base pressure conditions, to remote locations.

For further information consult your American Meter representative.

AMERICAN® METER COMPANY
INCORPORATED (ESTABLISHED 1836)

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JOHN WOOD
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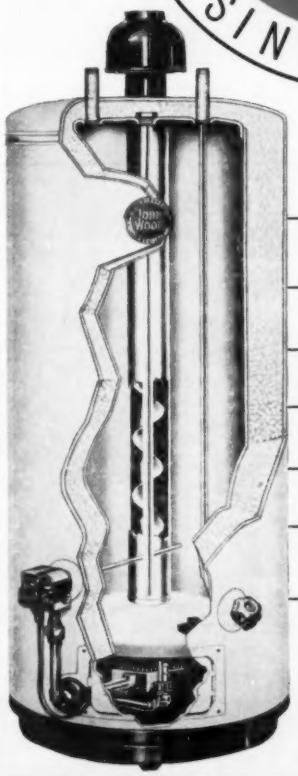
Glasslined and Galvanized in Upright and Table Top Models



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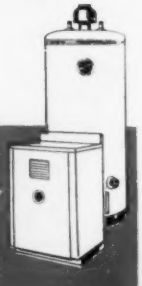

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BROKEN PIPES REPAIRED *in minutes!*

For permanent repair, simply install beside break, slide over, and tighten... Stainless Steel bands, Neoprene Gaskets. Write for literature.

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for **leakproof, pressure-tight connections**

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SEALING COMPOUNDS

Heat and vibration-proof, non-solvent, will not shrink, crack or crumble. Makes all assemblies leak-proof and pressure-tight. Prevents rust, corrosion, joint seizure.

7 BASIC BLENDS

LIQUID WRENCH®
The super-penetrating rust solvent

LOOSENS
rusted bolts, nuts, screws, 'frozen' parts

Liquid Wrench works *fast*... yet is absolutely safe for all metals and alloys.

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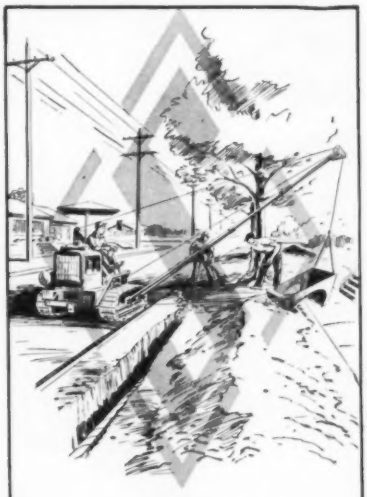
RADIATOR SPECIALTY CO.
Charlotte, North Carolina

SOLDER SEAL



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combines quality with efficiency to give the best possible value.

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Ada, Michigan

SIGN OF TRANSMISSION LINES
SATISFACTION DISTRIBUTION SYSTEMS

people • *Continued*

Frank Griffith
Peoples Gas

Karl B. Nagler
Peoples Gas

elected a vice president and will be responsible for industrial relations; EMORY A. MANLOVE, formerly assistant vice president, was elected vice president and will be in charge of operation; RALPH L. BRAUCHER, assistant vice president, was elected to the additional post of assistant comptroller; and ROBERT M. DREVS, secretary, was elected to the additional post of assistant vice president.

E. F. BEATIE, supervisor of meter reading, collections and credit for Southern California Gas Co. Los Angeles, has been named western district representative of the Public Utilities Industry Committee of the National Association of Credit Men.

Robertshaw-Fulton Controls Co. has named BEVERLY D. TAYLOR treasurer of the company. He was formerly controller. WALTER H. STEFFER, who resigned as treasurer, will continue as the company's secretary. JOHN C. C. BYRNE, controller of the Grayson Controls division, is now controller, and JAMES A. WITT has been appointed assistant secretary.

ARTHUR L. YEAGER, chief field engineer of Mountain Fuel Supply Co.'s distribution division, has been appointed manager of the company's new Logan (Utah) dis-

Leslie Brandt
Peoples Gas

Stuart Barrett
Peoples Gas

trict office. Also named to the Logan office was OWEN T. BRINGHURST, who will be in charge of the commercial department.

BYRON A. HANEY has been named northwestern sales manager for Bucyrus-Erie Co., South Milwaukee. From his headquarters in Seattle, Mr. Haney will supervise sales in Washington, Oregon, Idaho, and Montana.

GEORGE C. BERGTHOLDT has been elected a vice president of the Webster Engineering Co. Inc., Tulsa, a subsidiary of Surface Combustion Corp. Mr. Bergtholdt has been with the company for 24 years, having been chief engineer since 1937 and assistant general manager since 1956.

Robert Drevs
Peoples Gas

G. C. Bergtholdt
Webster Engr.

W. K. VENATTA is managing Oronite Chemical Co.'s Oak Point (La.) plant, succeeding T. I. CLAUSEN, who has transferred to California Research Corp.

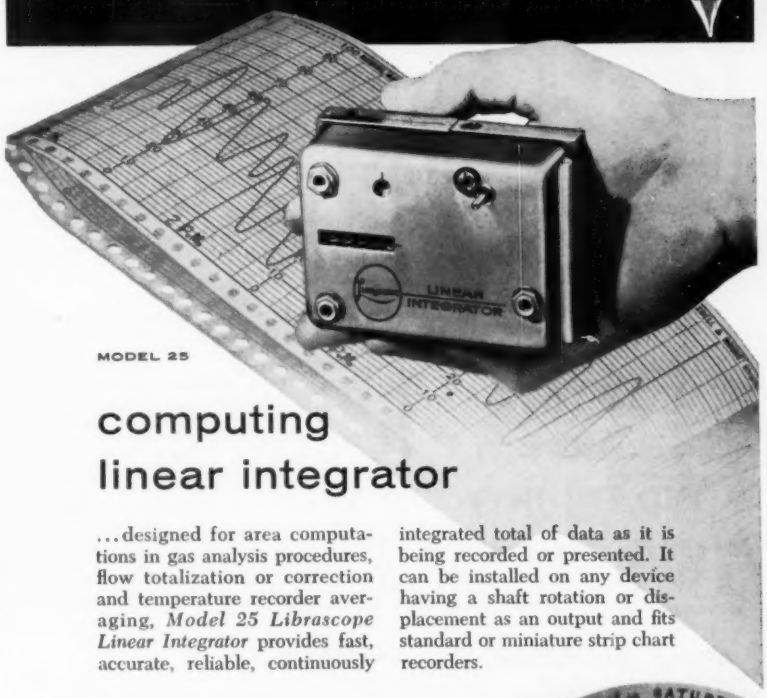
M. H. DIELS is now budget director for Arizona Public Service Co., Phoenix.

FRED W. ARGUE, vice president and engineering manager, and EDWARD J. FORD, vice president and senior construction manager, of Stone & Webster Engineering Corp., New York, have been elected directors of the firm. The company also announces the appointment of

Ralph Braucher
Peoples Gas

Emory Manlove
Peoples Gas

automatic
flow computation
for the GAS INDUSTRY



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...designed for area computations in gas analysis procedures, flow totalization or correction and temperature recorder averaging, *Model 25 Librascope Linear Integrator* provides fast, accurate, reliable, continuously integrated total of data as it is being recorded or presented. It can be installed on any device having a shaft rotation or displacement as an output and fits standard or miniature strip chart recorders.

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flow computer

...made by Librascope, simplifies computations in the orifice measurement of fluids in gas well, lift, transmission and distribution operations. It provides continuous square root integration of static and differential pressure, eliminating expensive time costs and inaccuracies of hand integration.

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GENERAL PRECISION EQUIPMENT CORPORATION

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At our Main Plant
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715 Elizabeth Ave.
Elizabeth, New Jersey

people • *Continued*

THEODORE E. CASSELMAN, JR., as chief chemical engineer.

Vulcan Rubber Products Division of Reeves Brothers, Inc., New York, has appointed L. R. ERVIN general sales manager.

J. FELTON FURRH is now superintendent of gas measurement in the engineering department of Southern Union Gas Co., Dallas. He will asist and advise on measurement problems in the company's operating properties in Texas, New Mexico, Arizona and Colorado.

GERALD L. ANDRUS, vice president of New Orleans (La.) Public Service Inc., has been named chairman of the newly organized corporations division of Tulane University's Fund.

ALVAN MARKLE has been appointed director of purchases for Walworth Co.

GEORGE B. BECKS is the newly appointed treasurer and controller of Union Malleable Manufacturing Co., Ashland, Ohio.

A. PHILLIP D'HAEM has assumed the newly created post of director of export sales for Gar Wood Industries Inc., Wayne, Mich. Prior to the new appointment, Mr. D'Haem was European director of sales with headquarters in Paris.

American Meter Co., Philadelphia, has named J. P. WILSON III as sales representative for the Atlanta sales district, and CLIFFORD E. ALDEN to the post of sales engineer for the Wynnewood, Pa. sales district.

O. G. HOWE, engineer on the general office staff of Oklahoma Natural Gas Co., Tulsa, has been promoted to mechanical supervisor, compressor stations. He replaces D. R. ALLEY, who retired on Aug. 1.

Dresser Manufacturing Division, Bradford, Pa., has appointed LYMAN D. WARNER manager of subsidiaries and ROBERT D. CRANE manager of purchasing. Mr. Warner joined the company in 1955 as assistant to the general manager of sales. Mr. Crane has

CUT COSTS
ON UNDERGROUND
PIPING JOBS

...with a GREENLEE PIPE PUSHER

Installing pipe underground is quick and simple this way. With a GREENLEE Hydraulic Pipe Pusher *one man* pushes pipe through the ground—under streets, railways, walks, lawns, floors. Saves time, cuts costs through elimination of extensive ditching as just a short trench accommodates the Pusher. No tearing up of pavement, lawns, floors... eliminates tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. Pusher often pays for itself through timesavings on first job or two.

No. 790 GREENLEE PUSHER For 3/4 to 4-inch pipe. Six speeds—5,600 to 40,000 lbs. pushing pressure.

No. 795 GREENLEE PUSHER For pipe larger than 4-inch, concrete sewer pipe, large drainage ducts. Six speeds - 25,000 to 150,000 lbs. pushing pressure.

POWER PUMP For both sizes of GREENLEE Pushers. Pushes pipe at rate of two feet per minute.

TOOLS FOR CRAFTSMEN
GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 1950 Columbia Ave., Rockford, Ill., U. S. A.

been with Dresser since 1956 as assistant to the general manager, purchasing.

EMERSON C. UNDERWOOD has been appointed New York state regional sales representative for Empire Stove Co. He will headquarter in Rochester.

Two appointments to the Stamford (Conn.) administrative staff of Citizens Utilities Co. have been made. PETER J. MCTAGUE is assistant to the vice president and MARTIN P. KURIC is executive assistant, reporting directly to the treasurer and vice president.

COURTLANDT S. GROSS, president of Lockheed Aircraft Corp., has been elected a director of Southern California Gas Co., Los Angeles.

Pittsburgh (Pa.) Coke & Chemical Co. has promoted two executives to head activities of its expanded Protective Coatings division. NORMAN T. SHIDELER was elected president of Insul-Mastic Inc., a newly acquired subsidiary, and ARTHUR E. GRAY succeeds Mr. Shideler as the division's general manager. Mr. Shideler will also act as technical advisor to the vice president of the chemical division.

FRANCIS A. KNITTLE has been named chief field engineer for Mountain Fuel Supply Co., Salt Lake City, and ALVIN E. JACOBSON is business supervisor of the new Logan office.

American Meter Co. has named W. V. STOCKTON, JR., product manager for all American Meter measurement and regulation equipment for the L.P. gas industry, and for Ohio Injector Co. lubricated plug valves. He will headquarter at American's new executive offices in Philadelphia. American Meter also has named RAYMOND B. WILMARTH manager of the Midwest division, with headquarters in Chicago.

W. V. Stockton, Jr.
American Meter

R. B. Wilmarth
American Meter

Peerless

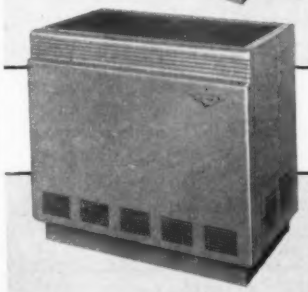
WITH THE GREATEST SELLING FEATURES IN YEARS!

HAS THE MOST COMPLETE LINE OF GAS HEATERS *for every need!*

Your reputation for quality merchandise will be enhanced when you display and sell PEERLESS GAS FIRED CONSOLES because Peerless are gas heating specialists with over 70 years experience and a record for leading the field in smart designs, greater heating efficiency and maximum dollar value.

***The RADIANT FRONT* GAS CONSOLE**

Only Peerless has exclusive Directional Louvres that provide best circulation and keep walls clean. This is only one of the many desirable features that sell Peerless . . . and keep it sold. A full range of sizes . . . 15 models in all . . . from the 14,000 B.T.U. "Mighty Midget" to the 65,000 "LowBoy."



***The PLAIN FRONT* GAS CONSOLE**

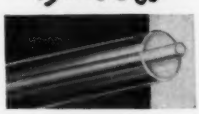
Peerless MANUFACTURING DIVISION
OF DOVER CORPORATION
LOUISVILLE 1, KENTUCKY

Length after length . . . Mile after mile . . . Every inch of

BUSADA BUTYRATE (PLASTICS) GAS PIPING IS IDENTICAL!

IT'S CLEAR! YOU CAN SEE IT'S BY Busada

It is transparent . . . made from one specific material formulation containing the same physical properties shipment upon shipment. Its high quality is constant. Made to same O.D. as steel pipe with 2 wall thicknesses. Close tolerances insure leakproof, trouble-proof ease of installation. Complete line of fittings.



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SURE LOCATIONS EVERY TIME!

- NO WIRES, BATTERIES or SWITCHES—simple, powerful magnetic action, factory adjusted to YOUR geographical location assures unfailing results!
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- NATION'S MOST WIDELY USED LOCATOR!
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ORDER NOW — Wire or call Kirby 1-4200 collect for fastest delivery!

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Koenig ALL-STEEL CABS for JEEPS

FULL AND HALF CABS

Full Cab and Model 151J King Winch Illustrated

★ Protection
★ Comfort
★ Safety
★ Convenience

Roll-down windows, full opening . . . full panel-board head lining and masonite door lining . . . safety glass throughout . . . all-steel welded construction . . . door locks.

KING WINCHES

King Winch on A-120 (4x4) International truck.

There's a front-mount King Winch designed to fit your specific needs . . . for ½-ton through 2½-ton trucks . . . pulling capacities of 8,000 to 19,000 lbs.

P.T.O.-driven King Winch on Willys Jeep

FOR ALL WILLYS JEEPS, 4 WD TRUCKS AND 4 WD STATION WAGONS.

Power-take-off-driven King Winch models 130J and 131J for CJ-3B and older-model Jeeps, can be transferred to CJ-5 and CJ-6 Jeeps . . . nothing extra needed.

King Winches for International trucks available through International dealers.

Koenig cabs and King Winches for Willys vehicles available through all Willys dealers.

Koenig IRON WORKS, INC.

WEST 12th and ELLA BLVD., HOUSTON 7, TEXAS

Directors of Quebec Natural Gas Corp. watch Director Frank A. Schultz, of Dallas, try his hand during welding on first spread of company's line for main distribution header across Montreal Island to serve 1.6 million people. The line will connect with the Trans-Canada system. From left: Welder Jean Laporte, Mr. Schultz, President Maurice Forget, Leonard Milano, Vice President-General Manager Kenneth B. Lucas, Marcel Piche, Joseph A. Page, and Paul A. Clarke.

J. N. CLAYTON JR., is now manager of the rate and regulatory department of Arkansas Louisiana Gas Co., Shreveport. He succeeds M. D. LAGRONE, who has resigned to become treasurer and vice president of the Consolidated Gas Utilities Corp. in Oklahoma City. T. M. ELGIN is assistant manager of the Ark-La department.

F. WARREN COOPER, vice president and comptroller of Public Service Electric & Gas Co., Newark, N. J., since 1954, has retired. Mr. Cooper started with the company in 1920 as an accountant, became chief accountant four years later, assistant general auditor in 1945, assistant comptroller in 1948, and comptroller two years later.

CARL H. GOBRECHT has retired as manager of the commercial department of Mountain Fuel Supply Co., Salt Lake City. Mr. Gobrecht joined the company in 1929. DOUGLAS R. RUDY, chief clerk and credit manager, has been named commercial manager.

CARL O. KNIERIM has been appointed manager of heat treat sales for the Gas Machinery Co., Cleveland. Mr. Knierim, who has been with the company for 16 years, has most recently served as chief engineer for the industrial furnace division.

FOR SALE

Used Bryant Silica Gel Dehumidifier, Size—8R, Serial No. 0957, Hourly Btu input 95,000, CFM CAPACITY 800.

THE TAMPA GAS COMPANY
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The R. W. STAFFORD CO.

GAS CONSULTANTS—ENGINEERS—CONSTRUCTORS

Natural Gas Conversions
Plant Management and Operation
Peak Shaving and Standby Plants
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FOR SALE

METERS — American Meter Co. 2-40 tinned case $10.00, Metric Metal Iron Case 3LTB $12.00. Most tested, painted, and with fittings. Inquire of The Jones Gas Co., P. O. Box 528, Hagerstown, Maryland.

WANTED

75 miles 6" used pipe line suitable for transmission purposes.

Minimum wall thickness .188"

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GAS Magazine, 198 S. Alvarado St.,
Los Angeles 57, California

Deaths

FRANK GLENNEY, 53, residential and commercial sales manager, Houston district of Houston Natural Gas Corp., died recently in Anaheim, Calif. He was there on a vacation. He began with Houston Natural in 1931 as a solicitor. He moved into the sales department of the company in 1940, following four years in the service division.

Chilton
PUBLICATIONS

Foremost IN THE FIELDS THEY SERVE

CALL A CHILTON MAN

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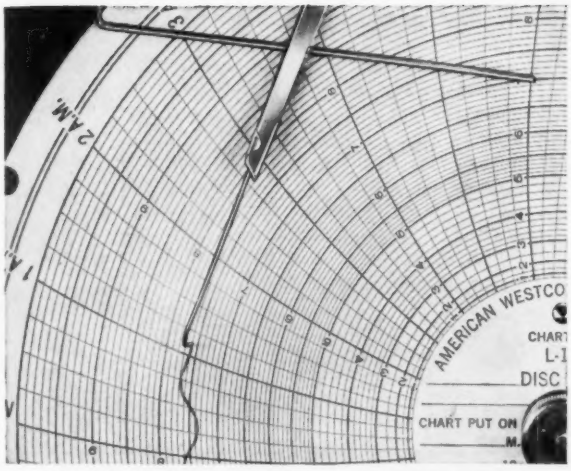
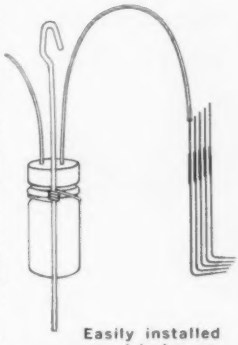


CANNON PENS

assure legible charts ...eliminate inking problems



Cannon controlled-flow capillary meter pens provide exceptional dependability and long life with minimum maintenance. Easy to install, these precision pens produce accurate chart records of maximum legibility and continuously record up to a full year without refilling reservoir.

Easily installed as original or replacement equipment in all standard recording instruments. Available in five sizes and angles — special pens upon request.

- **Ends Unrecorded Intervals.** Unaffected by pulsating flows, chart speeds, rapid pen movement.
- **Sealed Ink Supply.** Prevents clogging from atmospheric contamination.
- **Two-Way Ink Flow.** Stainless steel writing point is positioned above ink level in reservoir and ink flows in either direction by capillary action—eliminates smearing, blurring.
- **Special Pens.** Designed and produced to customer specifications where special inking problems make standard pens impractical.

Write today for information

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INCORPORATED (ESTABLISHED 1836)

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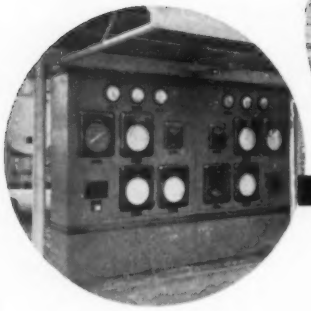
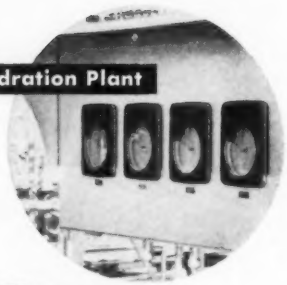
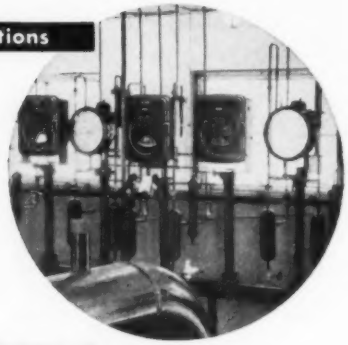
SUPPLIERS TO THE GAS INDUSTRY for Ironcase, Tinned Steelcase, Aluminumcase and Welded Steelcase Meters • American-Westcott Orifice Meters • Instruments • Reliance Regulators • Apparatus • Valves







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. . . under Foxboro Control

From well to city gate, natural gas flows more efficiently, with less supervision, in Foxboro-instrumented pipelines. At every stage — production — processing — transmission — delivery — Foxboro Instruments measure and automatically control gas movement and related operating variables. The resulting highly integrated control system keeps loads perfectly balanced . . . vital equipment constantly protected. For information on the latest methods of pipeline control, contact your nearby Foxboro Sales Engineer, or write **The Foxboro Company, 3410 Norfolk St., Foxboro, Mass., U.S.A.**

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Instrumentation for Pipelines

GAS

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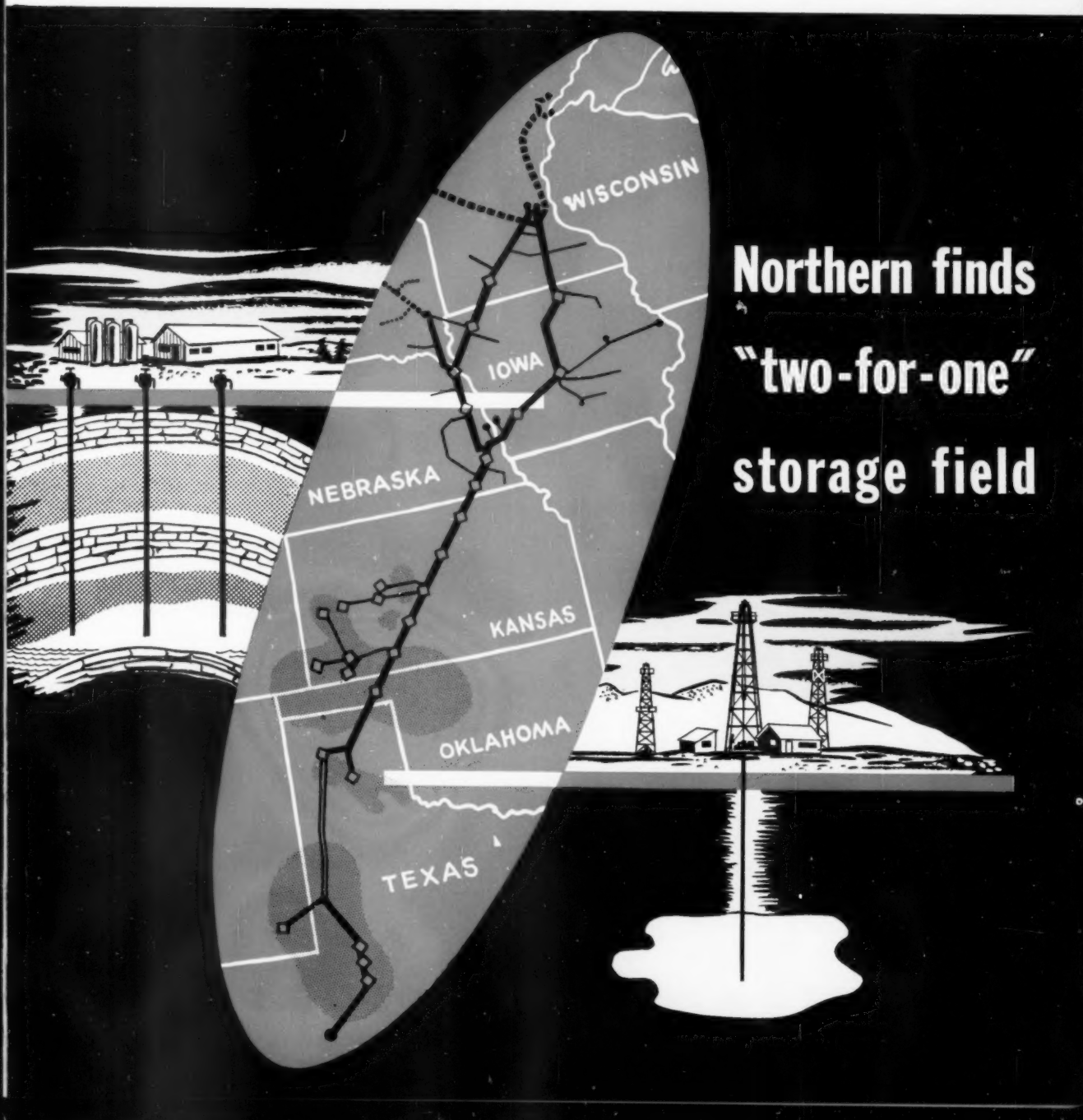

Northern finds "two-for-one" storage field

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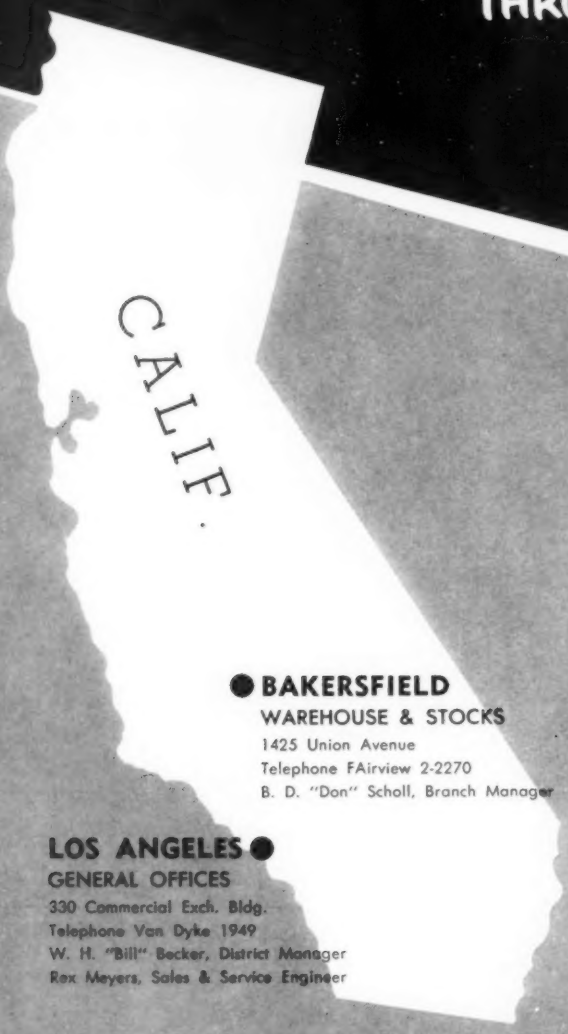

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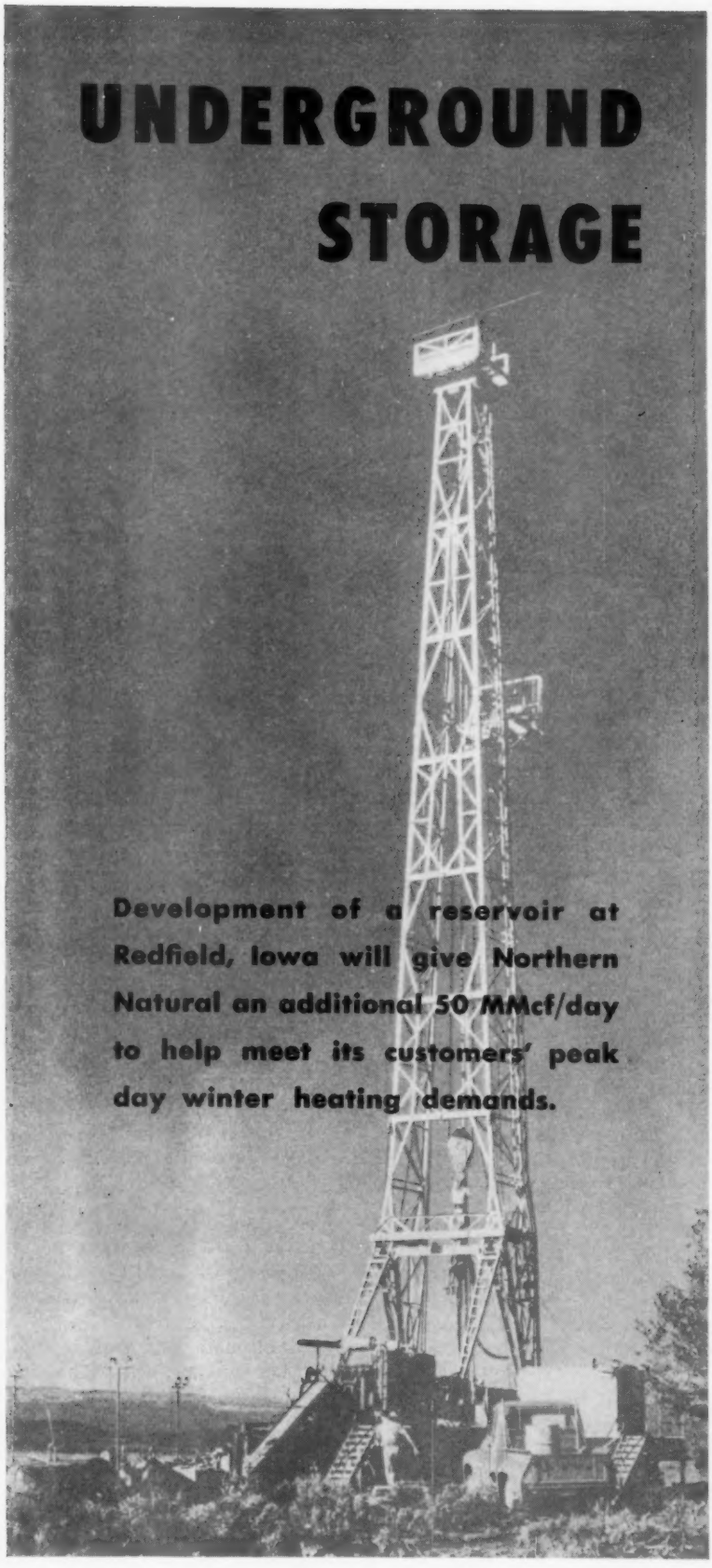

Development of a reservoir at Redfield, Iowa will give Northern Natural an additional 50 MMcf/day to help meet its customers' peak day winter heating demands.

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By **RALPH J. SMITH,** Omaha, Neb.

IN developing an underground storage field near Redfield, Ia., Omaha's Northern Natural Gas Co. has the prospect of a second —and larger—underground storage facility as, so to speak, a bonus.

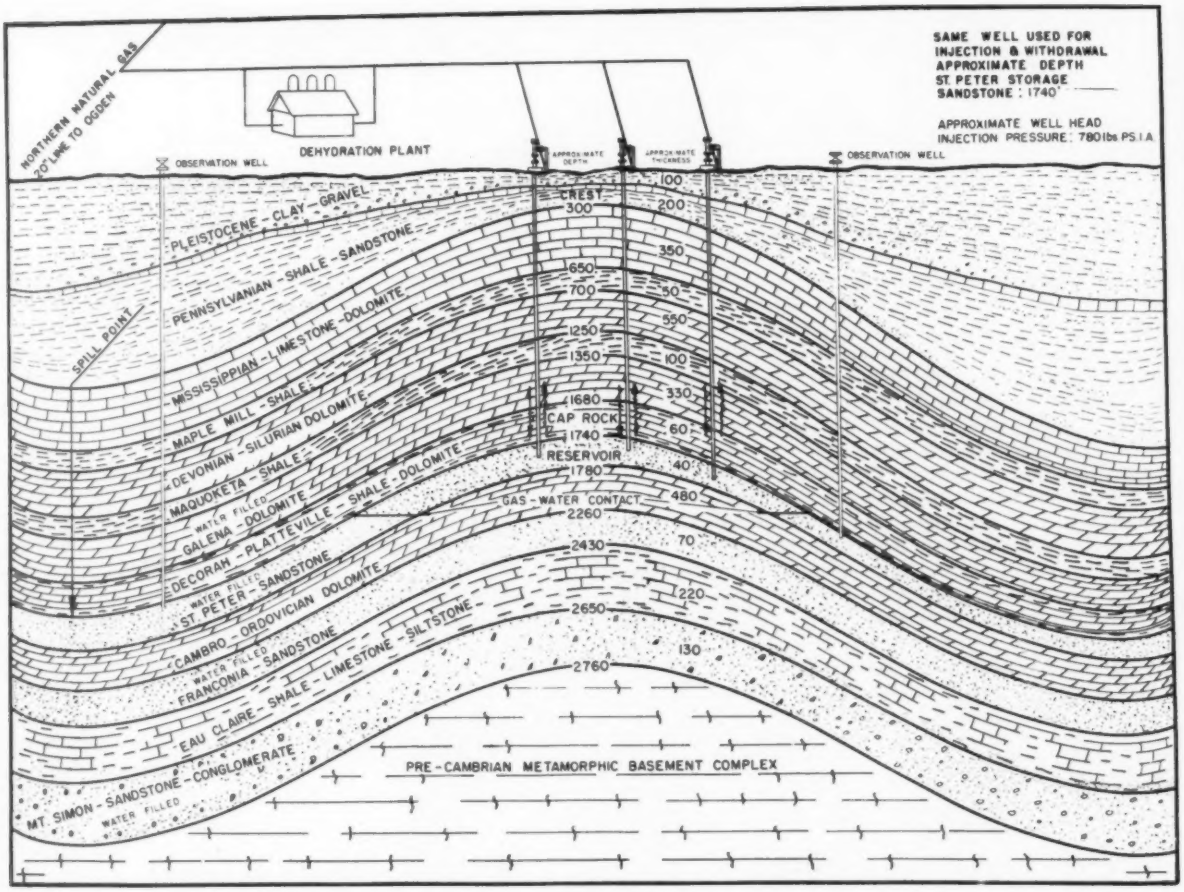
The two-for-one likelihood comes through the geological circumstance that the Redfield locale has not one but two potential storage fields stacked one atop the other.

Down 1740 ft below the surface, weighted by three layers of caprock, is the 40-ft layer of St. Peter sandstone, a rock with an unusually high porosity and permeability. It is this stratum which is being used for initial development.

Another 910 ft deeper in the earth, separated by two intervening layers of rock, is the massive, 110-ft thick layer of Mt. Simon sandstone, of even better storage capability. Its ultimate storage potential is four times that of the St. Peter sandstone.

The vertical placement of the two layers means that Northern can carry out initial work, which is cheaper because the formation is less deep, in the St. Peter sandstone. With data gathered, lessons learned and tests compiled, the knowledge can then be applied to the more massive Mt. Simon formation with a maximum of efficiency and a minimum of expense. Savings from this shortcut promise to be scaled to the substantial cost of development of the facility. Northern Vice-President Myrven L. Mead believes that when the final costs are added up, the savings that will result from being able to use the St. Peter formation as a pilot operation—although a commercially practicable one in itself—for total utilization of the field will be very sizable.

When the dual development is



Cross-section drawing of geological make-up of Redfield underground storage field.

accomplished fact—and the timetable has yet to be firmed—prospects are that the Redfield installation will be the largest water sand field anywhere. Ultimate storage capacity is expected to be around 250 billion cu ft. This compares with the 90 billion cu ft of the Herscher field near Kankakee, Ill., which currently is believed to be the nation's largest of the water sand type.

Northern's preoccupation with underground storage, of which the Redfield facility is the fruition, stems from the circumstance of the firm's locale and operations. Except for a chunk of Siberia, Northern's territory has the widest temperature spread on earth; the average domestic customer uses 15 times as much gas in the winter as in the summer. The area also is one with a relatively light concentration of industry, which means a paucity of interruptible users. The sum of these factors is a wide variance in demand. Delivery is at system capacity of 1194 MMcf a day during winter. In summer, for want of interruptible customers to sustain maximum load, demand goes as low as 500 MMcf.

Two factors prompted Northern several years ago to begin its quest for an underground field. Such an installation held the promise of peak day capacity at one-fifth to one-eighth the cost of building lines back to its West Texas fields. At the same time, injecting storage gas would bring full utilization of transmission facilities that were loafing along at half capacity during the summer months. Embarked on the search, Northern went ahead with considerable persistence, testing two domes near Minneapolis—which would have been an ideal location—and three in the general area of Omaha before coming up with the Redfield dome, located 30 miles west of Des Moines, Ia. So far, Northern has invested over $7 million in search and development activities; costs are expected to total over $10 million by the time the project is completed.

The St. Peter dome, which was the reward of so much time and money, in contour is shaped like a giant clamshell. It is 11 miles in one direction and four miles in the other. Its attributes include:

—The relatively high porosity of 22 per cent. Because the stone is permeated with water, initial storage is expected to occupy about 11 per cent. Since the gas tends to dry out the stone, this figure ultimately is expected to approach 17 per cent. The St. Peter's estimated ultimate capacity of 50 billion cu ft is based on a lesser figure more conservative than that of 17 per cent.

—Water drive. Indications are that, due to the water, pressure fluctuations over a long period

of time will be relatively narrow, thereby simplifying injection procedure. Tests indicate that gas comes out of the wells at least as fast as it went in, at a pressure of about 800 psig.

—Water seal. Water moves through the formation at the rate of about one foot a day. The spill point on the upstream side of the dome is 20 ft higher than on the downstream. Preliminary indications are that the velocity of the water will not tilt the gas-water contact as much as this 20-ft difference.

—Recovery, based on a 100-day schedule, is one-half the total injected volume of gas.

—Location. The Redfield locale is only 30 miles from a Northern compressor station at Ogden, Ia. The Ogden plant was modified, with a minimum as a part-time injector station. For the Mount Simon formation, which has a pressure requirement of 1200 psig, erection of a compressor station near the crest of the field will be necessary.

—Tightness of seal. Only leakage out of the St. Peter sandstone has been into the formation immediately above, where it is trapped by the two additional caprocks. The small volume of leaked gas is taken out by a vent well and is used to feed into the branch line supply to three nearby towns.

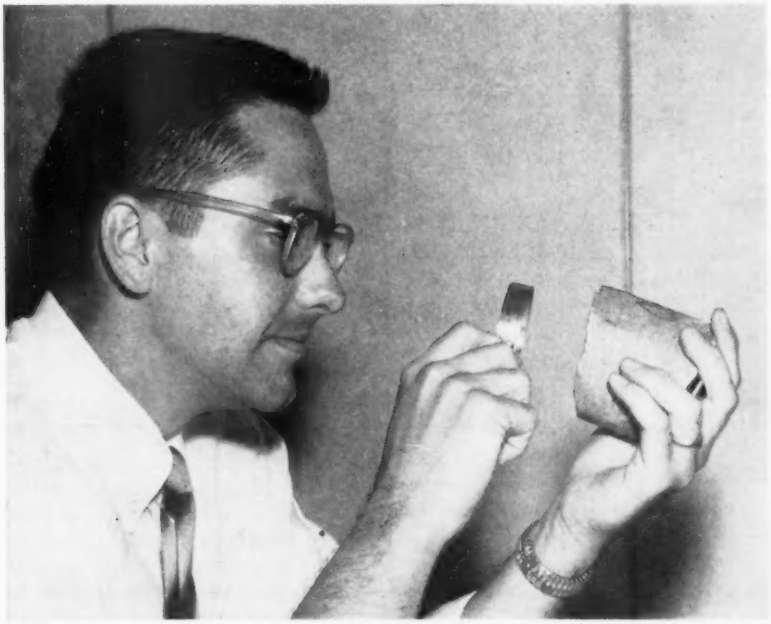
—Absence of existing wells. In contrast to storage facilities in depleted gas fields punctured by old wells, the Redfield area had only one existing well. It has been reworked and put to use as an observation well.

Vincent Martinson, senior gas storage engineer (left) and vice president M. L. Mead talk over a problem concerning Northern Natural's new underground storage field.

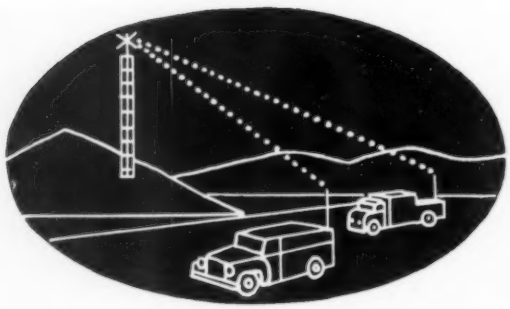
In preparation for utilizing the field this winter, Northern now is injecting gas into the underground reservoir. Currently it has 9 billion cu ft in storage and is adding to it at the rate of 45 MMcf a day. By October, it expected the total figure to be over 12 billion ft. At the recovery rate of 50 per cent per season, this total will permit 100-day withdrawal this winter at the rate of 50 MMcf a day. "In addition, test quantities are being injected into the Mount Simon formation," Mr. Mead said.

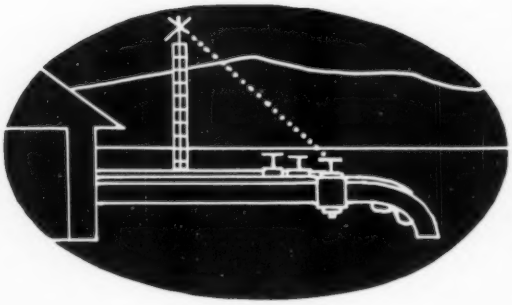
"Ultimately," he said, "it is expected that the St. Peter formation will provide peak day capacity of 250 MMcf. With compete development of the Redfield installation, the combined St. Peter and Mt. Simon storage should add up to 1 billion cu ft or more of peak day capacity." This is approximately equal to Northern's present system capacity.

"It also means that for $10 million, Northern will have secured peak day capacity that would cost around $80 million in pipelines built back to the field," Mr. Mead said. And in gas operation, as in horse racing, an 8-to-1 payoff is very satisfactory indeed. ■



Gas storage engineer Jerry Guinane studies a core from Northern Natural's underground storage field at Redfield, Ia.





Split channel system analysis

Part 1—Why more channels are needed

FIVE years ago the increasing need for additional communication channels became evident. A casual study of the channel allocation arrangement and the characteristics of the equipment available indicated that a substantial improvement could be made in the utilization of the communication spectrum. Monitoring of any land mobile communication circuit indicated that the saturation point was rapidly approaching. It was evident that the capacity of a single channel was limited to approximately 100 mobile communication units. To further aggravate this problem, the growing variety of users required an increased sharing of channels which demanded a high degree of coordination by the Federal Communications Commission.

Referring to *Fig. 1*, it can be determined that for any given area, a minimum of four frequencies is required to provide protection against adjacent channel interference without resorting to special antenna radiation patterns. As the number of areas and types of service increase, the number of channels required are related to the protection required and therefore will increase by the square of the number of protection areas required.

The only practical approach to this problem was to *split* the existing channel allocations. In other words, make adjacent channel assignments at 30-kc intervals instead of 60-kc intervals, which was the existing assignment scheme.

A better understanding of the reasoning behind channel allocations can be had if we consider the basis on which the FCC determines the bandwidth required. The general technical requirement defined in part 2 of the FCC Rules and Regulations define the necessary bandwidth as "the width of the frequency band which is necessary in the overall system, including both transmitter and receiver for the proper reproduction of the desired information and does not necessarily indicate the interfering

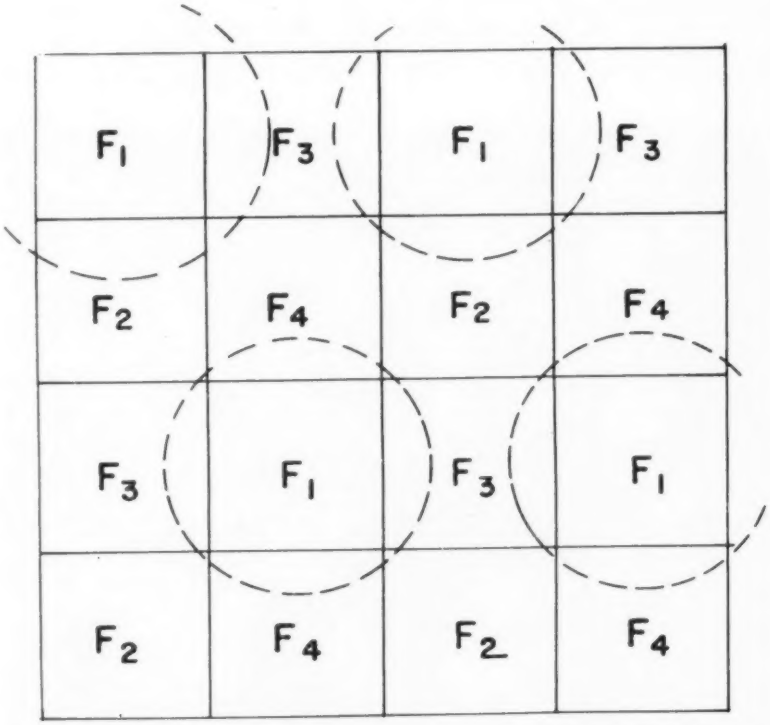


Fig. 1. Adjacent area protection. Explanation: when N = the number of protection areas before the same frequency repeats, and F = number of frequencies required, then $F = (N + 1)^2$.

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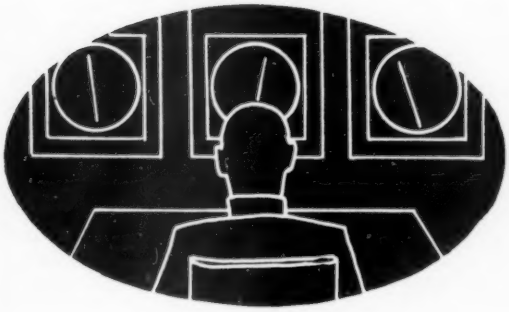

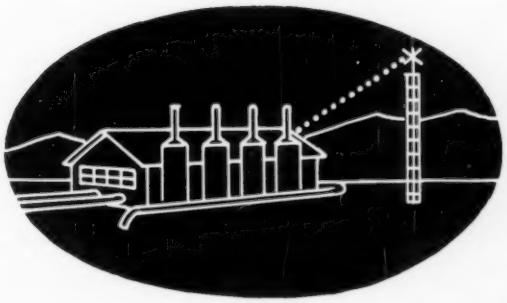

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characteristics of an emission." A formula is given which permits you to calculate the necessary bandwidth from the desired audio frequency band and the desired carrier deviation. This formula is stated:

BW = 2M + 2DK
K = 1 for commercial telephony
D = ½ the maximum total deviation
M = represents the maximum modulating frequency

From this, it can be determined that the necessary bandwidth for the existing 60-kc channel allocations is 36 kc and for the proposed split channel or narrow band, it would be 16 kc.

Fig. 2A shows the frequency increments which make up the 60-kc channel assignment plan. Since it is recognized that the transmitter will occupy more than the necessary bandwidth in out-of-band radiation, it allows for frequency drift and higher frequency modulation components. The FCC defines the authorized bandwidth as "the maximum width of the band of frequencies as specified in the authorization to be occupied by an emission." For the present wideband assignment, that is 40 kc. For the proposed narrow band, it will be 20 kc. In order to allow adequate protection between adjacent channels, an additional 20 kc was provided as a guard band. As noted in *Fig. 2A*, this is the area in which the split channel assignment will be made. In Part 2.524 of the FCC Rules and Regulations is defined what is known as occupied bandwidth. This is "the region in which 99 per cent of the radiated power of the transmitter will appear and usually extends out to approximately 2 per cent of the carrier frequency which includes any discrete frequency on which 0.25 per cent of the radiated power appears.

Fig. 2B shows the manner in which the re-assignment of channels will be made at 30-kc intervals. It will be noted that the guard channel is now half of what was previously allowed. Therefore, attenuation between channels will have to be more rapid with relation to frequency.

Our present concern over the split channel is brought about by the adoption of FCC Docket 11253 originally dated Jan. 12, 1955, which became effective on Oct. 15, 1956. The four most important re-

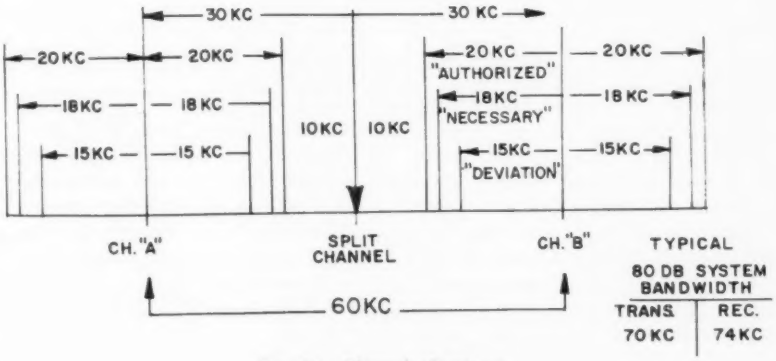


Fig. 2A. Channel allocations.

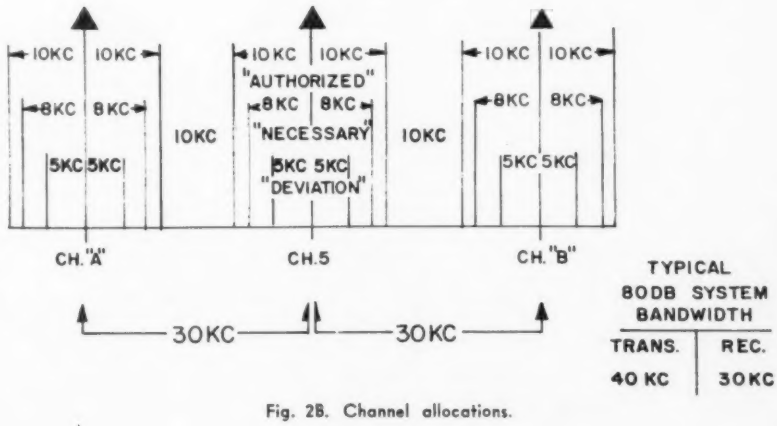


Fig. 2B. Channel allocations.

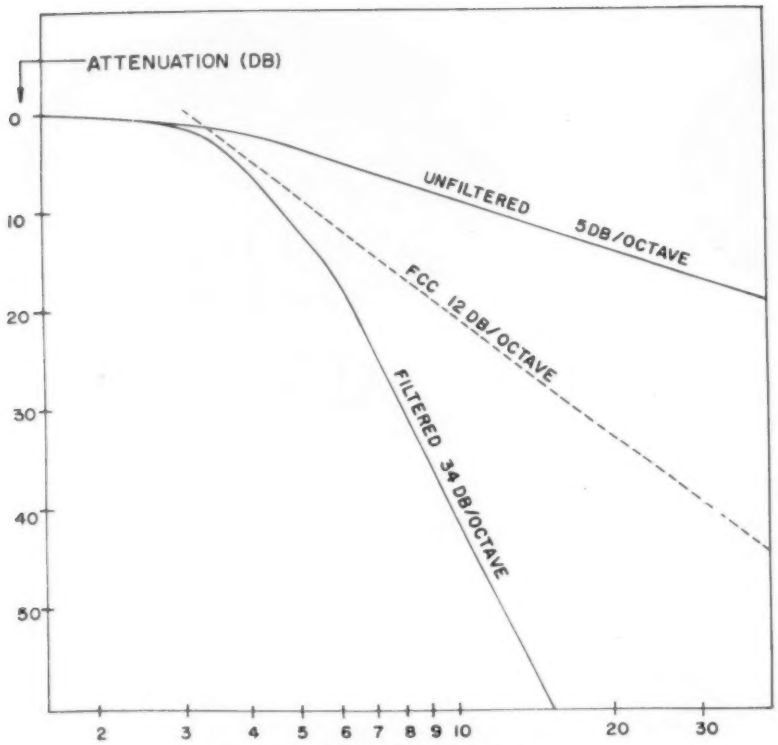


Fig. 3. Modulation filter characteristic.

quirements of this docket are as follows:

(1) It requires existing licensees to conform to the split channel standards within seven years. This means that anyone who now has a mobile communication system operating with equipment which is adequate for 60-kc allocations will either have to buy new equipment meeting the new standards at the end of seven years or will have to modify his existing equipment to meet the new allocation standards at that time.

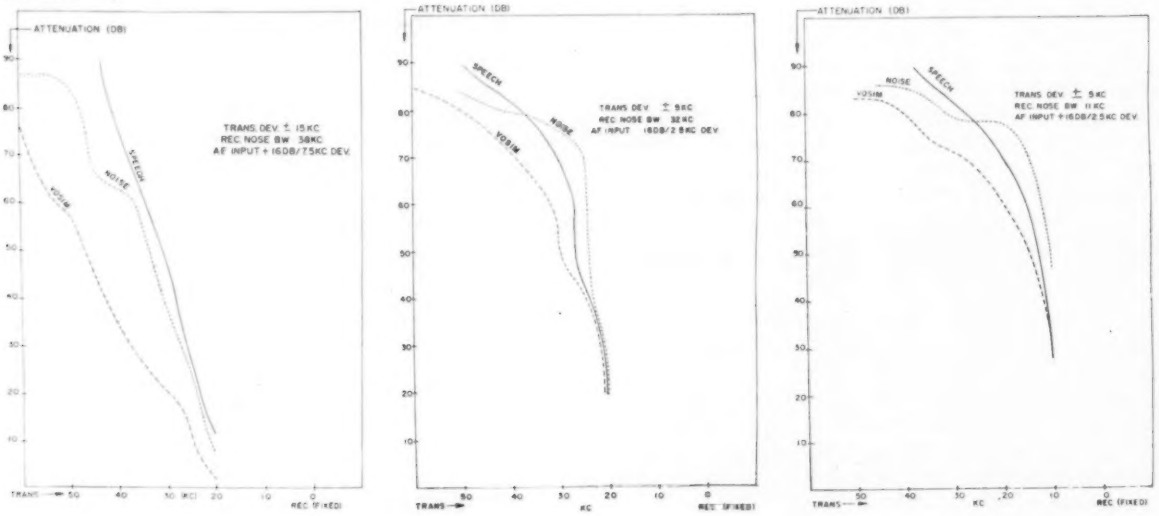
(2) It requires new licensees to conform after two years (i.e., Nov. 1, 1958). This means that anyone now obtaining a license to operate a mobile communication system does so with the knowledge that he should either buy equipment now designed to perform within the new standards or equipment which can be modified to conform to the new standards. Any non-conforming equipment licensed before this date will not have to conform until Oct. 31, 1963.

(3) It permits the mixture of existing systems having the present 60-kc allocations with new systems having 30-kc allocations. However, such inter-mixed allocations will be made subject to a review by the FCC in cooperation with users and frequency coordination groups, of the existing allocations in the area of interest.

(4) It establishes new technical standards to provide adequate interference limits as related to emission characteristics and systems stability.

Early in 1953, a joint industry committee was organized and became popularly known as the JTAC or Joint Technical Advisory Committee. It was the purpose of this committee to define minimum acceptable characteristics and realizable standards of engineering achievement. The result of this committee's findings became the basis of the FCC's decision to adopt Docket 11253. The JTAC reviewed system and equipment characteristics with the purpose of making practical recommendations. The scope of their discussions included the various forms of interference, including modulation splatter and transmitter noise, intermodulation, and co-channel probability of cap-

Fig. 4. Adjacent-channel interference attenuation. A (left)—wide band system; B (center)—modified wide-band system; C (right)—narrow-band system.



ture effects. It included also the anticipated difficulties with intermixture of wide and narrow band systems during the transition period, which included consideration of practical carrier frequency control, audio frequency limits, audio frequency response and deviation limiting.

Two-frequency operation was analyzed. The adjacent system limits which would be experienced would be determined by the maximum effective geographical system allocation of frequencies and a review indicated that the maximum number of systems for a given location would be approximately 12. This was limited by accumulated interference from receiver oscillator radiation, transmitter noise and desensitization, transmitter intermodulation, receiver spurious response and combined transmitter-receiver frequency drift.

The system analysis indicated the following equipment characteristics should be considered:

The desired minimum effective receiver bandwidth and the practical design limits of skirt selectivity in the reduction of bandwidth, would increase susceptibility to random noise and reduced deviation would result in deterioration of the FM improvement factor. Higher gain audio systems due to the reduction of audio output would be required. This, in turn, would increase the consideration of circuit noise. The characteristics of the transmitter were considered, the most important being the rate of audio frequency cut-off above 2500 cycles. It was later agreed to extend this to 3000 cycles since field test indicated that there was insufficient improvement at the lower frequency cut-off point.

The most important problems concerning the deviation of the transmitter were the degree of effectiveness of the instantaneous deviation control which necessarily introduces a high order of distortion products. Another important consideration is the carrier frequency drift in both the transmitter and the receiver. It was recognized that precision crystals in temperature-regulated ovens having very tight tolerance would be necessary. As a result of their studies, the following recommendations were made:

(1) Split channel operation would be feasible.

(2) Improvement of overall systems selectivity would be required.

(3) Careful assignment of frequencies would be necessary.

(4) Definite consideration of physical separation of systems would be necessary.

(5) Users to be encouraged to use antenna farms for receivers and transmitters.

(6) A higher degree of user cooperation would be necessary.

(7) A recommendation for more rigid maintenance standards.

System characteristics which limit operating effectiveness

Adjacent channel interference

Adjacent channel interference consists mainly of modulation splatter and transmitter noise. Each of these is a product of the higher order of frequencies generated by the transmitter which produces sufficient deviation outside the assigned bandwidth of sufficient amplitude to be detected by a sensitive receiver on the adjacent channel. The modulation splatter is the result of the distortion products of the microphone amplifier and audio limiters. The characteristic of a quick-acting limiter due to its triangular wave shape is to produce a large number of higher frequencies which must be attenuated at a more rapid rate against the normal pre-emphasis characteristic of the transmitter. Otherwise, the sidebands will extend considerably beyond the assigned limits.

It is also recognized that the carbon microphone is a generator of a large number of harmonic products. In order to reduce the

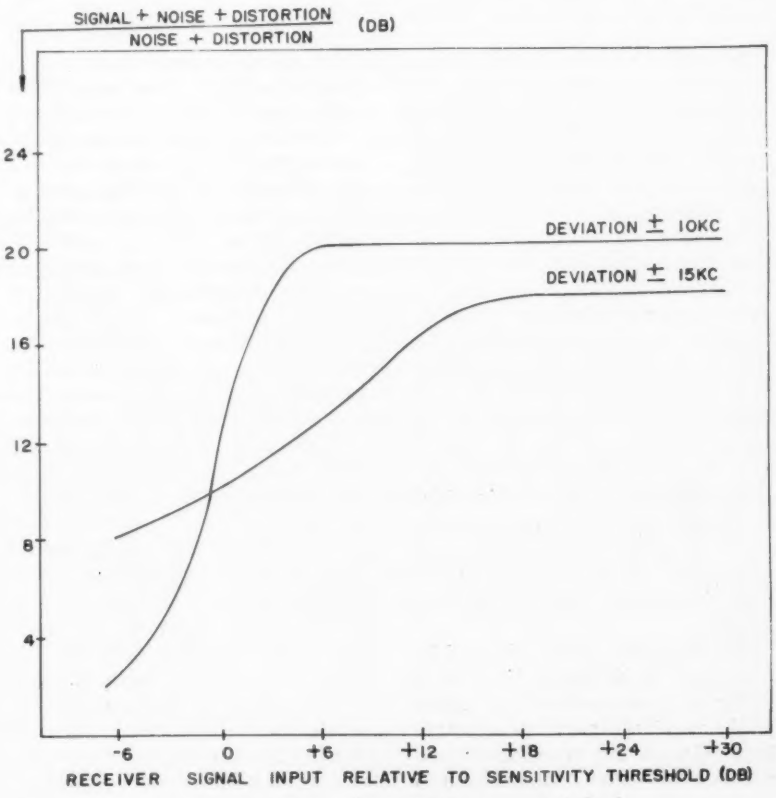


Fig. 5. 150 mc system SINAD improvement.

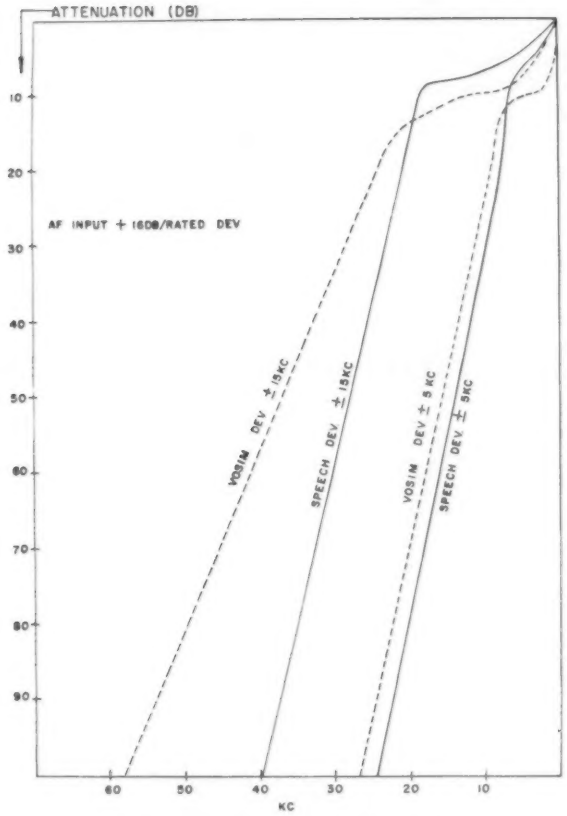


Fig. 6. Transmitter sideband attenuation.

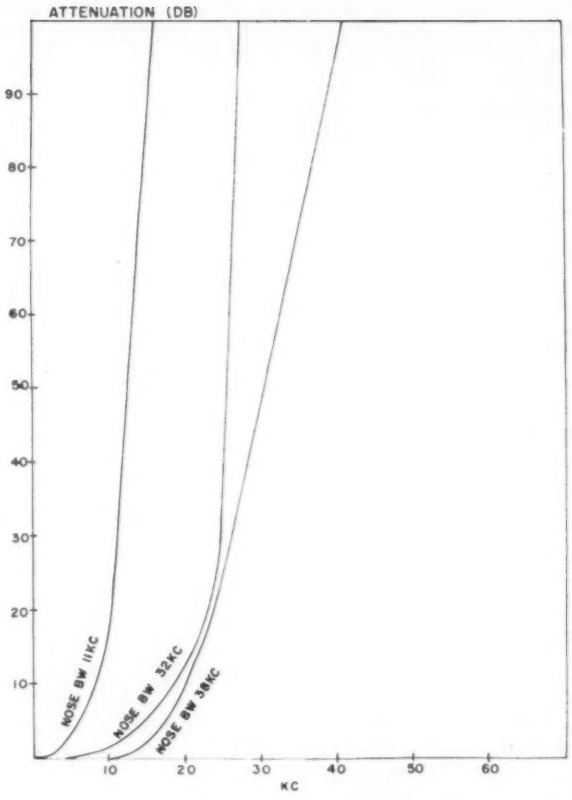


Fig. 7. Receiver quieting selectivity.

effect of these distortion products, a filter whose characteristics are shown in *Fig. 3* is inserted between output of the audio amplifier and the modulation input. It is designed to comply with the FCC technical requirement of 12 db per octave attenuation slope. Its actual effective attenuation is better than 30 db per octave. This is due to the shunt capacity effects of the audio system. It will be noted that the unfiltered output of the transmitter is attenuated at a very much lower rate of 5 db per octave. In order to obtain a picture of how this affects the adjacent channel receiver, systems tests have been made in which a transmitter on the adjacent channel is coupled to a companion receiver and its frequency shifted in 5-kc increments toward the receiver.

The transmitter is modulated by a speech simulating device and a series of measurements are taken of the required amount of attenuation between the transmitter and receiver to prevent more than 6 decibels of SINAD reduction. The same series of tests is also conducted for transmitter noise alone. Based on the known relationship of the simulated speech device and actual speech, a curve for the speech interference is extrapolated. The results of these tests are shown in *Fig. 4A, B, and C.*

It might be well to pause a moment to describe the meaning of the term "SINAD." This is a ratio of signal-to-noise and distortion improvement which has been adopted as a standard measuring criteria for land mobile receivers. It represents the minimum signal which can be tolerated and identified relative to the noise and distortion products produced by the overall system. A curve of these improvement characteristics is shown in *Fig. 5* in which it will be noted that there is a very rapid change in the immediate vicinity of the receiver threshold. The SINAD value has been arbitrarily chosen by RETMA as a ratio of 12 db, since by observation this has been noted to be the condition which fits the previous definition. It will be noted from this figure that as the deviation is increased, the rate of improvement is reduced and the maximum value of improvement is less. This is an indication of the increased number of distortion products produced by the modulation limiter.

Referring again to *Fig. 4C*, it can be seen that in the adjacent split channel, a narrow band receiver working next to a narrow band transmitter will attenuate the modulation splatter 82 db. On this same graph, you will note a curve labeled, "transmitter noise." This is the second of the more prevalent adjacent channel interference that will be experienced. It has the unfortunate characteristic of being very wideband and usually extends out to a megacycle or more from the carrier frequency at amplitudes of 70 to 80 db below the transmitter carrier. In the case of mobile units, these values are 15 db higher; in other words from 55 to 65 db below the transmitter carrier. The transmitter noise is a product principally of power supply noise, which

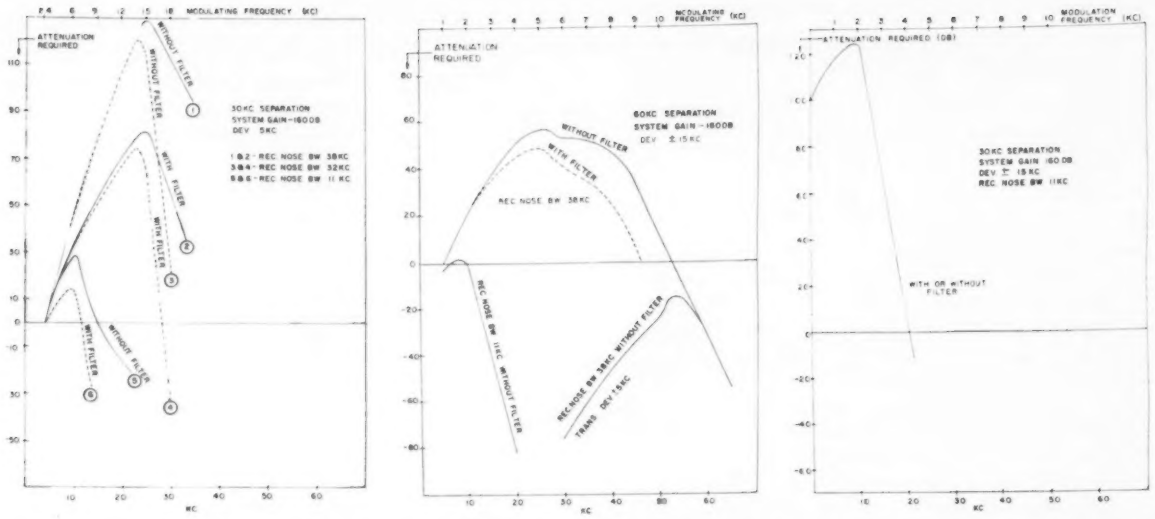


Fig. 8. Minimum permissible coupling—A (left)—30 kc channel separation; B (center)—60 kc channel separation; C (right)—30 kc separation WB transmitter, NB receiver.

in the mobile unit has its origin in dynamotor or vibrator power hash, and also in the circuit noise which is developed in the amplifier and modulator circuits of the transmitter. Some noise is also contributed by the input circuits, and a lesser amount of noise by the oscillator and multiplier circuits. From *Fig. 4C*, it can be seen that this interference can be attenuated 79 db in the adjacent channel receiver of a narrow band system. This noise also appears as modulation on any spurious carriers which the transmitter may generate and will increase in amplitude in the region of the spurious carrier due to the excessive deviation which is a consequence of the multiplication ratio.

At this point, it is well to analyze the combined attenuation which will be obtained when operating various combinations of wide and narrow band transmitters and receivers, either on split or standard channel allocations. The general characteristics of typical transmitter sideband attenuation and receiver quieting selectivity are shown in the curves of *Figs. 6 and 7*. If the net attenuation provided is calculated for each of a series of discrete sideband frequencies, particularly those related to known modulation frequencies, and are plotted on a graph which shows the difference between the system gain and the net attenuation, such a graph, which is shown in *Fig. 8A, B and C*, will indicate the minimum permissible system coupling relative to the system gain. From this graph, it can be determined what modulating frequency will produce what amplitude of interference for a given combination of wide and narrow band transmitters and receivers.

The results of these graphs are tabulated in *Table I* which shows the distance required between various combinations of receiver bandwidth and transmitter deviation characteristics to prevent interference and retain the designed system gain. In this case, the system gain has been selected as 160-db, which is developed by a 15-watt transmitter and a receiver having a 12 db, SINAD improvement sensitivity of .35 microvolts in a 50-ohm input. A study of this table makes it apparent that without the audio frequency cut-off filter, it would be difficult to locate narrow band transmitters very close to wideband receivers, and even with an audio frequency cut-off filter, the selectivity slope of the 38-kc receiver is inadequate under six miles. It is also apparent from the table that a narrow band receiver cannot be satisfactorily operated under less than 8.5 miles from a wideband transmitter.

Undesired signal generation

As will be seen from our later conclusions, intermodulation of both transmitters and receivers will be the most prevalent form of interference as the number of operating transmitters in any given area increases. A general rule is that the number of intermodulation products will increase by the cube of the number of transmitters operating simultaneously. The probability of this increases as the traffic density increases.

Intermodulation is the genera-

TABLE 1. SEPARATION REQUIRED TO MAINTAIN SYSTEM GAIN

Receiver Nose Bandwidth	Transmitter Deviation	Without AF Filter	With AF Filter
30KC CHANNELS			
38 KC	± 5 KC	9.6 miles	6.0 miles
32 KC	± 5 KC	7.7 miles	0.5 miles
11 KC	± 5 KC	26.0 feet	4.5 feet
11 KC	±15 KC	8.5 miles	8.5 miles
60KC CHANNELS			
11 KC	±15 KC	0.0	0.0
38 KC	± 5 KC	0.0	0.0
38 KC	±15 KC	630.0 feet	250.0 feet

TABLE 2. RECEIVER SPURIOUS RESPONSE

Where f_c = carrier frequency
f_o = 1st conversion injection frequency
f_{if} = 1st or high IF frequency
X_2 = 2nd converter crystal frequency

Frequency Combination	Typical Interference Signal Amplitude for (10DB/Q) DB / 1 Microvolt
$f_c - 2f_{if}$ = Image	122
$f_c - X_2$	118
$f_o + \frac{f_{if}}{5}$	136
$f_o + \frac{f_{if}}{2}$	114
$\frac{22f_c + f_{if}}{21}$	136
$\frac{20f_o + f_{if}}{19}$	136
$\frac{21f_o + f_{if}}{20}$	>137
$f_c + X_2$	118

tion of higher order product frequencies, many of which lie close to the originating transmitters frequencies and are a result of the non-linear mixing of the carriers in the transmitter output stages. The most significant products are those defined as third order; however, the fifth order products are significant if the generating carriers lie at the extremes of the band. They can be most easily recognized as frequencies which appear at uniform increments determined by the frequency difference of the two transmitters involved. They can be calculated by the simple formula of twice the frequency of one transmitter plus or minus the fundamental of the other. The rate at which the number of these increases is shown in *Table 3*.

Table 3 can be used to compute the actual frequencies which will be obtained. The actual number of products increases from 9 for 3 working channels to 50 for 5 working channels to 450 for 10 channels to 495,000 for 100 working channels. It becomes evident that as the number of channels in any given area increases this interference will become the limiting factor of system design. In any congested location, a minimum of 1 per cent frequency spacing of channels would be required. Whenever an intermodulation carrier is detected, it will be recognized as an excessively deviated carrier since in the first third order product, the modulation will be twice the deviation of the carrier nearest to the receiver in frequency or the carrier whose second harmonic is affected.

An idea of the magnitude of this interference can be obtained from referring to *Fig. 9*. This graph shows the amplitude of the resultant carrier with reference to the transmitter output. It can be seen that the attenuation ratio requires a progressively greater and greater amount of decoupling between the generating transmitters and that the conversion efficiency rises at a db/db rate, as the amplitude of the injection frequency into the near transmitter is reduced. Measurements have not been carried beyond 90 db decoupling due to limitations of the measuring equipment. However, it may be predicted that the conversion efficiency will become asymptopic until the limit of free space attenuation controls. It is this conversion improvement characteristic which makes it the most difficult of all interference to reduce and to avoid since its frequency falls directly in the passband of the receiver.

Another form of undesired signal generation is the spurious radiation of the transmitter which results from harmonics of the crystal oscillator being successively amplified through the multiplier stages and radiated from the transmitter output. The amplitude of these carriers will vary between 60 and 80 db below the transmitter radiated power and will extend through the band into the other bands, as well.

TABLE 3. DETERMINATION OF FREQUENCY COMPATIBILITY

Available Channel (MC)	Col 1	Col 2	Col 3	Col 4	Col 5
A					
B	B-A				
C	C-B	C-A			
D	D-C	D-B	D-A		
E	E-D	E-C	E-B	E-A	
F	F-E	F-D	F-C	F-B	F-A

Any identity determines that one of the sequence in those groups must be changed.

To check, successively subtract last row, column 5 to 1 from last channel. The results should equal the channels E back to A.

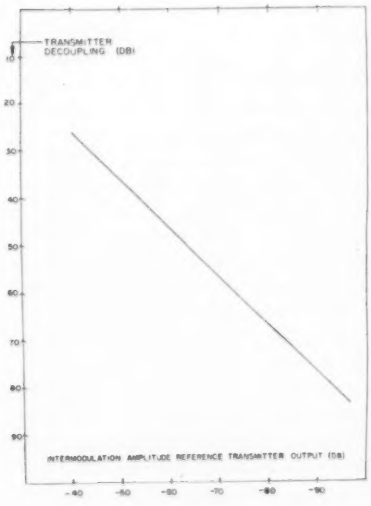


Fig. 9. Transmitter intermodulation.

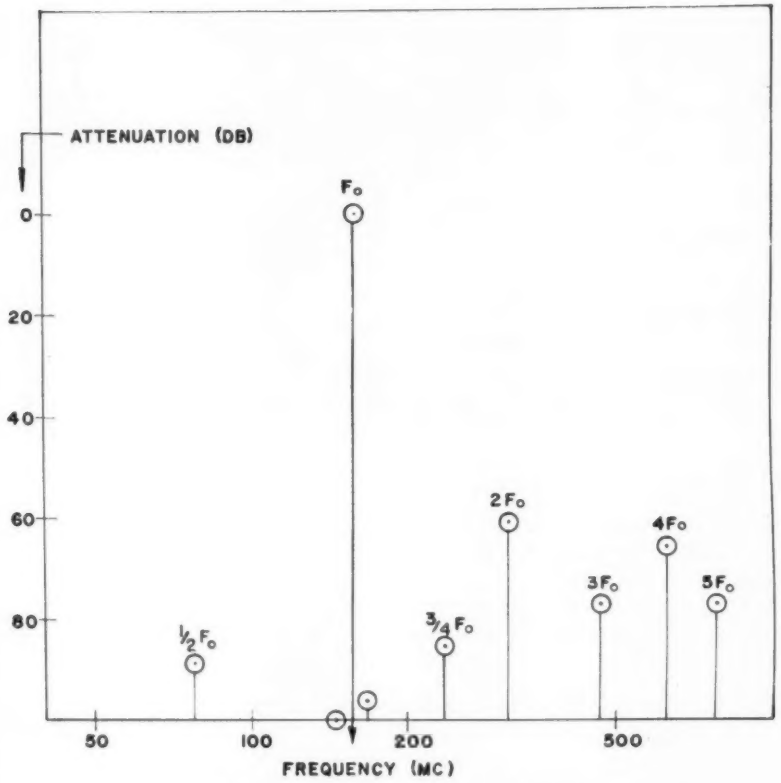


Fig. 10. Transmitter spurious radiations.

by a 150-mc transmitter. The ones which occur close to the carrier are products of multiplier and oscillator harmonics.

Another form of spurious radiation is that of the receiver injection oscillator. Most of these products are very low in value; however, they do limit how close another receiver may be located if it should happen to fall on the injection oscillator frequency multiple. Normally this frequency lies immediately below the band of operation but it is potentially possible at the higher end of the band to receive interference. The amplitude of these signals will be usually below —133 dbw at 100 ft from the receiver.

Undesired signal response

In this category we again encounter the characteristic of intermodulation, for in the receiver we again have a non-linear mixing device in the first converter, as well as nonlinearity in the RF and high IF amplifiers. This type of intermodulation is a little more difficult to predict as to amplitude and requires a considerable number of measurements since it varies over a wide range for changing amplitudes of the near and far carrier. *Fig. 11* shows in general the effect of the changing amplitude of the two carriers and at the point of inter-section of the two curves, determines the magnitude of equal amplitudes carriers which will produce the equivalent of a 20-db quieting signal. A study of this graph will show that when the carrier which is located twice the frequency spacing is the stronger the near carrier can be attenuated over a smaller range to eliminate the resultant interference product. However, if the stronger carrier is the nearer of the two, the required attenuation of the weaker carrier varies over a larger range, and in fact would require attenuations of signals to within 20 db above the receiver threshold to eliminate the product signal. In a typical receiver, if the strong carrier is attenuated to below —90 dbw, the IM products can be avoided.

Another form of undesired signal response is the spurious product combinations which are developed in the receiver as a result of the desired carrier, the first conversion injection frequency and the second converter crystal frequency combining in numerous sums and difference products to produce new spurious signals. *Table 2* itemizes a typical group of combinations whose potential interference can exceed the desired signal.

TABLE 4.
REQUIRED FREQUENCY STABILITY

Stability	Bandwidth Required
0.002%	22.0 KC
0.001%	19.0 KC
0.0005%	17.5 KC

Desensitization

This is the least recognized type of interference since it does not produce an audible output from the receiver. Its principal effect is to reduce the useful gain of the receiver and is due to the excessive biasing of the early stages from strong nearby carriers. Referring to *Fig. 12*, it can be seen that this effect extends to more than a megacycle away from the desired frequency. In situations where the receiver will be subjected to several carriers from nearby transmitters, this desensitization effect can be cumulative and almost continuous.

System gain and stability

With a reduction in receiver bandwidth and transmitter deviation, the tolerance permissible of a change in carrier frequency of the transmitter and the center frequency of the receiver becomes more critical. This is experienced when the very steep skirt selectivity of the receiver contributes to increasing the effective noise of the sideband energy of the transmitter. This also has the additional effect of reducing the net system gain and signal-to-noise improvement, and it makes the receiver more susceptible to random or impulse noise such as ignition interference due to the unbalance in the discriminator circuit. *Table 4* details the stability improvement required to reduce the bandwidth which will

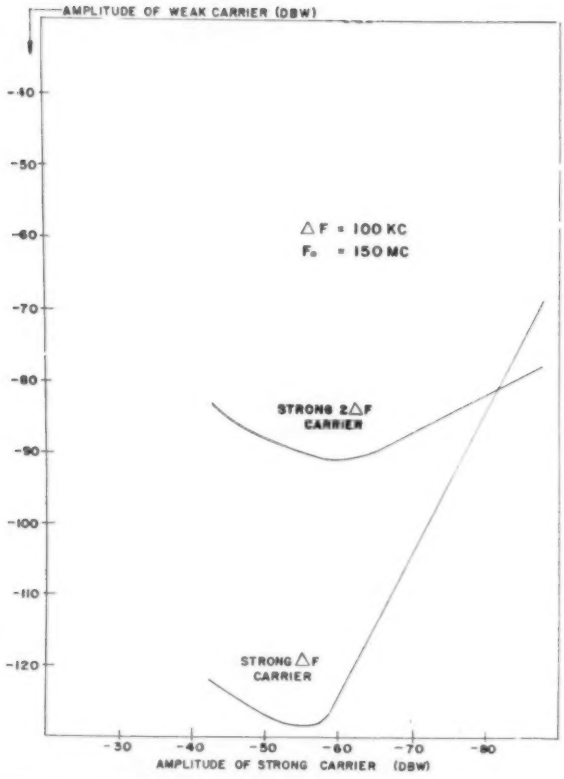


Fig. 11 (left). Receiver intermodulation.

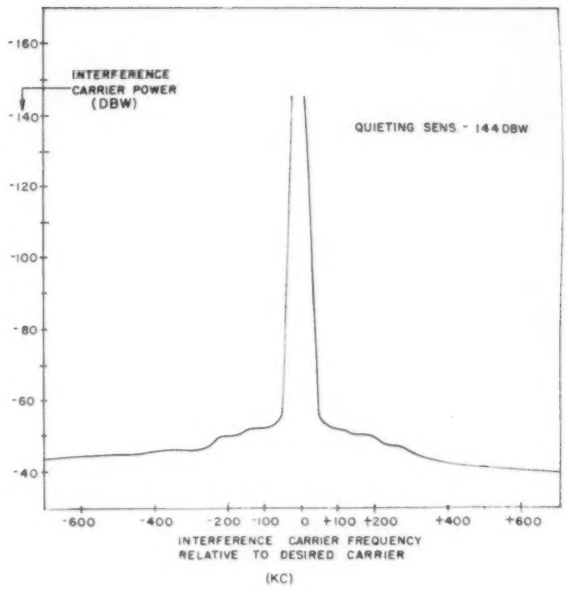


Fig. 12 (above). Receiver desensitization.

be occupied to within the limits of the necessary bandwidth as defined by the FCC.

General

In the specific discussions preceding, we have defined particular operating characteristics as related to channel-to-channel interference. We have not considered the co-channel form of interference. It is anticipated that with increasing assignment density, co-channel interference will become more prevalent. In the case of mixed wide and narrow band co-channel systems, the reduction of audio output will become a disturbing factor since there will be a 6-db difference between the audio of a wideband system and that from a narrow band system in any given receiver. Wideband receivers operating below 3 microvolts will experience a capture effect of 1½ db by a co-channel narrow band system due to the greater concentration of sideband energy. This effect will be most apparent at the receiver threshold. In the case of co-channel narrow band systems mutual interference will be most noticeable at the receiver threshold or "fringe" reception point. In summarizing the tests made by JTAC, it was found that the narrow band systems have a capture advantage over the wideband, but are more susceptible to crosstalk between systems. In other words, narrow band systems will interfere with each other to a slightly greater degree, but this effect will be washed out when the theoretical 3 db desired to undesired carrier ratio obtains. Extending it to the case of three co-channel systems, the ratio of interference of any two of them to the other will be approximately 1½ db better in narrow band systems and will reduce 1 db per 3 db of desired carrier to interfering carrier. Geographically, the desired separations between co-channel stations will vary from about four to six times the desired coverage radius and can be reduced to three to five times when separate transmitting and receiving frequencies are used. ■

Next month the author will conclude his analysis. He will discuss methods of reducing interference effects, and requirements for interference-free operation.

J. R. Neubauer, manager, systems communications engineering, Radio Corp. of America, received his educational training at Colorado University and Colorado A&M.

In 1944 he was appointed supervisor of communications for Continental Air Lines. In 1945, he organized a consulting service. In 1948, he became chief radio engineer of the Wyoming Highway Department. Two years later he moved to New Jersey to join the mobile and microwave section of RCA as design engineer. In 1953, he became supervisor of the systems communications engineering section, later becoming manager.

Washington editor Neil Regeimbal questions Rep. Harris regarding the future of his bill.

GAS exclusive interview

Gas bill has good chance of passage, says Rep. Harris

(Editor's note: Rep. Oren Harris (D.-Ark.) is a co-sponsor, with Rep. Joseph P. O'Hara (R.-Minn.), of H. R. 8525, the compromise natural gas bill to reduce federal controls over independent gas producers. He is also the chairman of the powerful House Interstate and Foreign Commerce Committee, which this year held hearings on and reported the bill. Mr. Harris, an Arkansas Democrat, thus is the key figure in the future of the legislation. In this exclusive interview, GAS *magazine presents Mr. Harris' views of the bill's future in his own words.)*

Question: The House leadership decided to postpone a final vote on the Harris-O'Hara bill until next year. How will that affect the bill's chances?

Answer: I fully realize there are differences of opinion as to the advisability of postponing the consideration of the natural gas bill by the House until next year. In my opinion, carrying it over will not in any way adversely affect the chances of the bill's passage.

As a matter of fact, this action could very well enhance the passage of the bill. We had a great deal of highly controversial legislation under consideration by the House and Senate. The members were anxious to conclude this session of the Congress and were in no mood to add other controversial legislation to the crowded schedule and thus postpone adjournment.

Question: What effect will the election year pressures have on the bill's chances in 1958?

Answer: I fully realize that those who serve in public office are more conscious of the problems, politically speaking, in an election year than in an off year. Consideration of the bill to amend the Natural Gas Act will be no exception.

However, I do not think this will have a great bearing on the chances of the bill's passage. The lines are fairly well drawn; those who are for the bill have so determined the course and those who are against it have likewise taken their position. The industry and others supporting the legislation will undoubtedly be as affected in their urgency during the election year as will be the opposition during the election year.

Question: Do you expect the President to work for the bill during adjournment?

Answer: While I cannot speak for the President, I do know there are various public statements, and personal messages sent to me (indicate) he is for the bill and will promote it in my opinion during the adjournment as he will when Congress reconvenes.

Question: Will the House vote be close?

Answer: From past experience and from what I know about the division of the controversial bill, I expect it to be very close in the House.

Question: Should the bill fail to pass in 1958, what effect would that have on the future of the gas industry?

Answer: If the bill fails to pass, it will in my opinion have a disastrous effect on the future of the gas industry and thus the consumers who are demanding more and more every day of this premium fuel. The natural gas industry will have no alternative if the bill fails to pass than to make other arrangements and adopt altogether different procedures for the utilization of this natural resource.

Question: Do you expect the gas producers to continue to support the compromise bill?

Answer: This bill is a compromise supported by producers, long lines, natural gas companies, and distributors. There have been some producers apprehensive about it and they have given their support reluctantly.

Since, however, they fully realize the existing chaotic situation cannot continue, this is all they expect to get. A great majority of the natural gas producers will in my opinion continue to give their active support for it.

Question: Do you expect the bill to be brought up early in 1958?

Answer: When the Speaker of the House, Mr. Rayburn, announced that the bill would be carried over until next year, it was indicated it would be brought up early in the next session.

I think it is important that the bill be scheduled at an early date and expect that it will be. ■

GAS exclusive

Quick action keeps Gas Service Co. from "losing" St. Joseph, Mo.

Fig. 1. This cracked mainline gate valve threatened Gas Service Co. with loss of St. Joseph, Mo.

By **HAROLD WRIGHT, Pipeline Superintendent,** Cities Service Gas Co., Oklahoma City

GAS companies hate the words "lose a town" as they hate no other phrase. They know what it means to lose a town.

Cities Service Gas Co. and the Gas Service Co. were confronted with the threat of losing a town of 85,000 population recently when a cracked mainline gate valve was discovered on the line serving St. Joseph, Mo. (see *Fig. 1*).

A quick decision on the part of management of Cities Service Gas started the ball rolling to save the day. A telephone conference settled the details of this emergency and a truck was dispatched to deliver the split tee fittings required for insertion of plugging machines and for by-pass connections.

While the split tees were enroute, flange bolts on the bottom half of the cracked gate were replaced one at a time with bolts long enough to reach from flange face to flange face of the gate and through the companion flanges. This was done to reduce leakage and to prevent the crack in the bottom of the gate from becoming larger (*Fig. 2*).

Upon arrival of the two split tees, they were immediately welded

Fig. 2. Flange bolts were replaced one at a time on cracked valve.

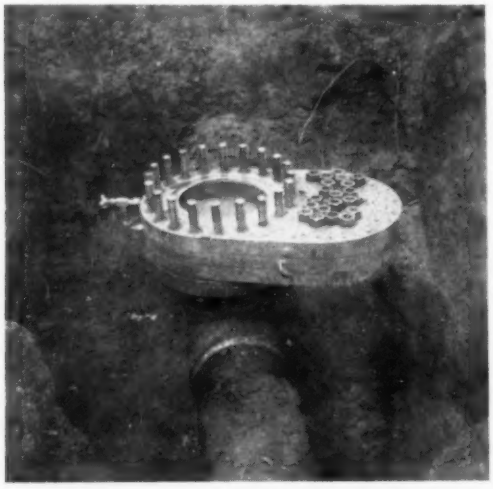
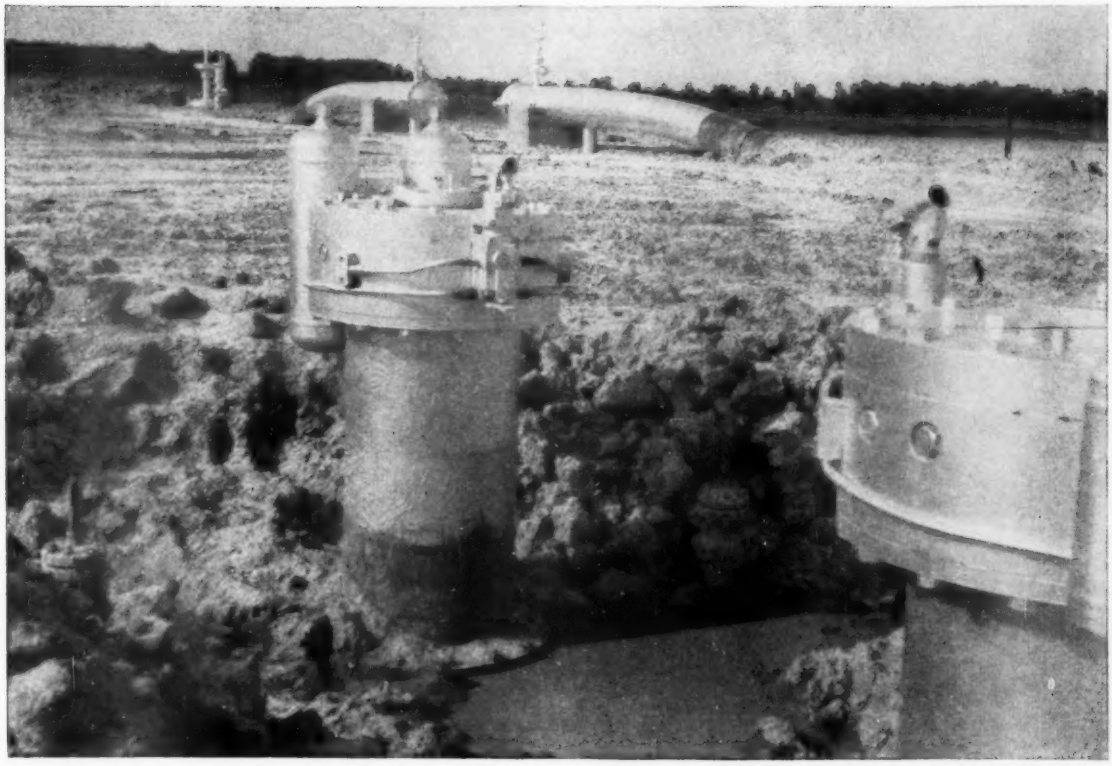


Fig. 3. Special tapping valve was installed as service was continued.



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Figs. 4 and 5. Tapping machine was mounted on each valve to cut hole in top side of line.

Figs. 6, 7, and 8. Views showing Stopples mounted on valves, with 4-in. by-pass line connected between Stopples.

text continues on page 153

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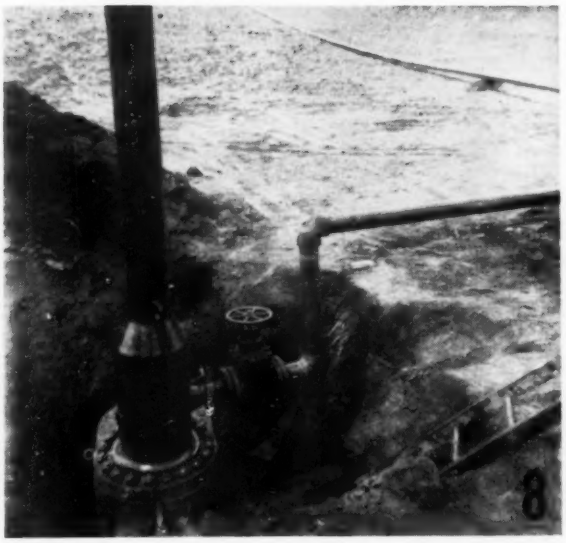

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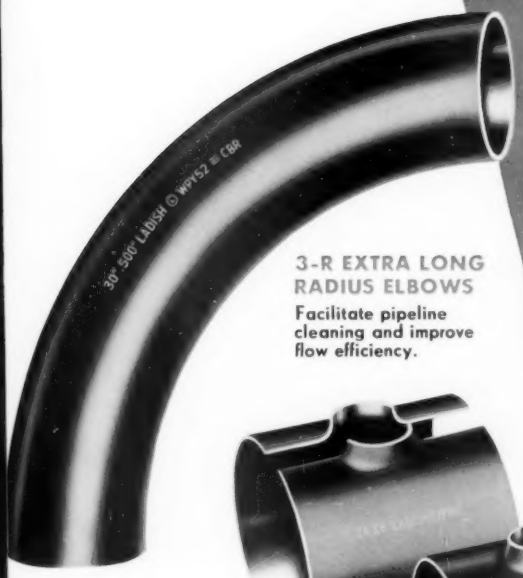

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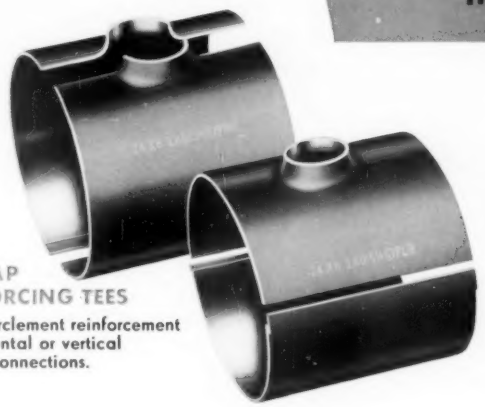

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Fig. 9. Hydraulic power unit was used to extend sealing elements of Stopples into position.

Fig. 10. Isolated part of line was blown down to permit installation of new gate valve.

Fig. 11. Retired meter header was replaced with new pipe in adjacent part of line.

Fig. 12. Another view of meter run header that was replaced during period line was by-passed.

to the 16-in. line at predetermined locations on either side of the cracked gate. It took two welders about six hours to weld these fittings on the line. By this time the truck arrived with the rental equipment necessary to tap and plug the line through the split tees and to provide connections for temporary by-pass piping.

The equipment rented from T. D. Williamson Inc. consisted of two 16-in. special "BV Sandwich Type" tapping valves, two 16-in. Stopple plugging machines and a Model 760 WmSON-Hillco tapping machine with engine-driven hydraulic power unit.

First, the tapping valves were bolted to the Lock-O-Ring flanges of the split tees.

A unique feature of these 16-in. BV valves is compactness (face-to-face dimension of only 8.25 in.) and weight of only 1900 lb (*Fig. 3*).

The tapping machine was then mounted on each valve in turn to cut a 15 1/16-in. hole in the top side only of the 16-in. line (*Figs. 4 and 5*).

When the tapping operations were completed, the Stopples were mounted on the BV valves, and a 4-in. by-pass line connected between the Stopples (*Figs. 6, 7 and 8*). Next the sealing elements of the Stopples were extended into position using the hydraulic power unit (*Fig. 9*).

Then the isolated section of the line between Stopples were "blown down" to permit replacement of the cracked gate and installation of an additional gate to the system. (Compare *Fig. 10* with *2*.)

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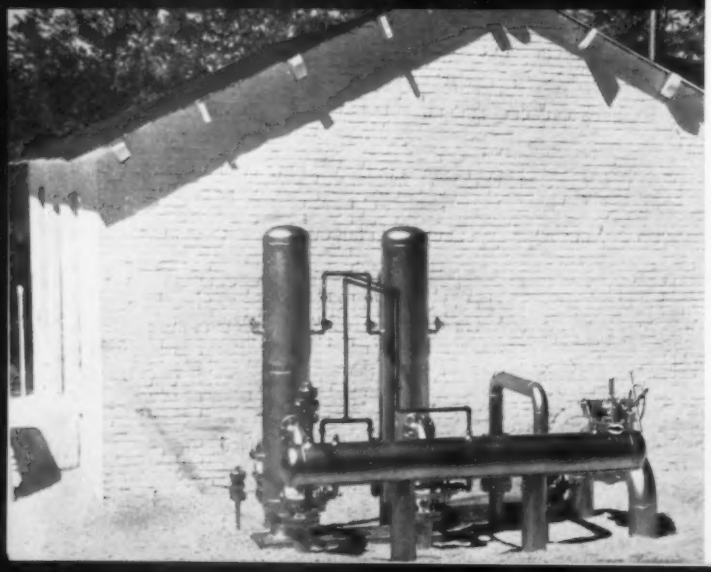

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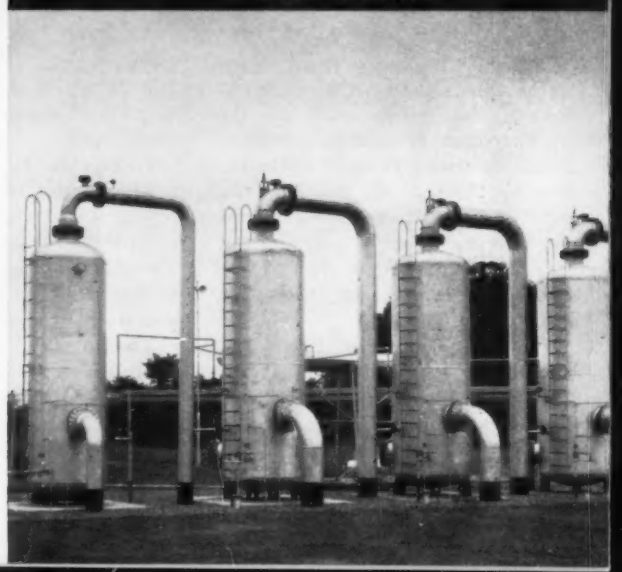

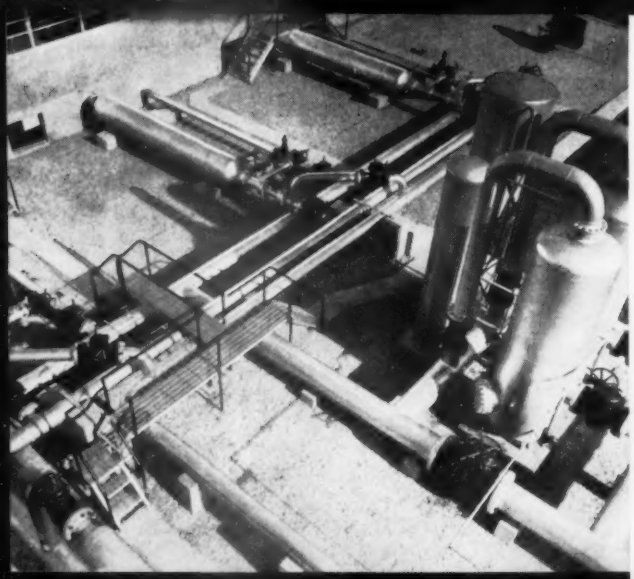

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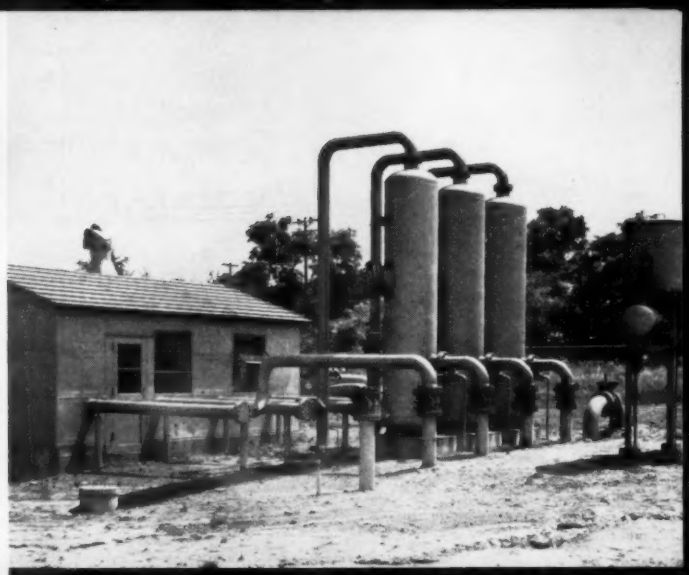

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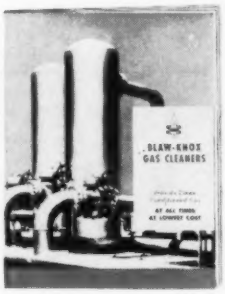

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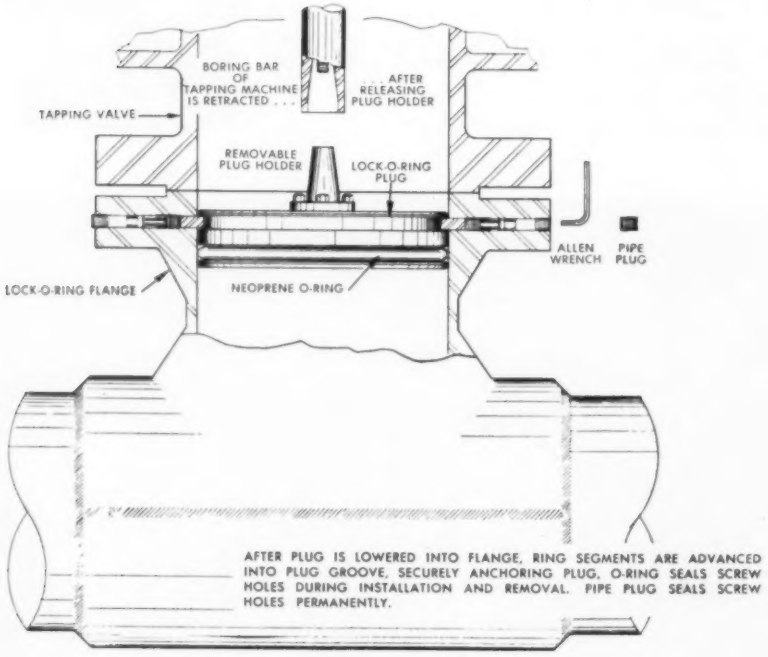
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NEOPRENE O-RING
AFTER PLUG IS LOWERED INTO FLANGE, RING SEGMENTS ARE ADVANCED INTO PLUG GROOVE, SECURELY ANCHORING PLUG. O-RING SEALS SCREW HOLES DURING INSTALLATION AND REMOVAL. PIPE PLUG SEALS SCREW HOLES PERMANENTLY.

Fig. 14. Cut away drawing shows how plug was anchored in flange.

In an adjacent part of the isolated section a retired meter run header was replaced with new pipe (*Figs. 11 and 12*).

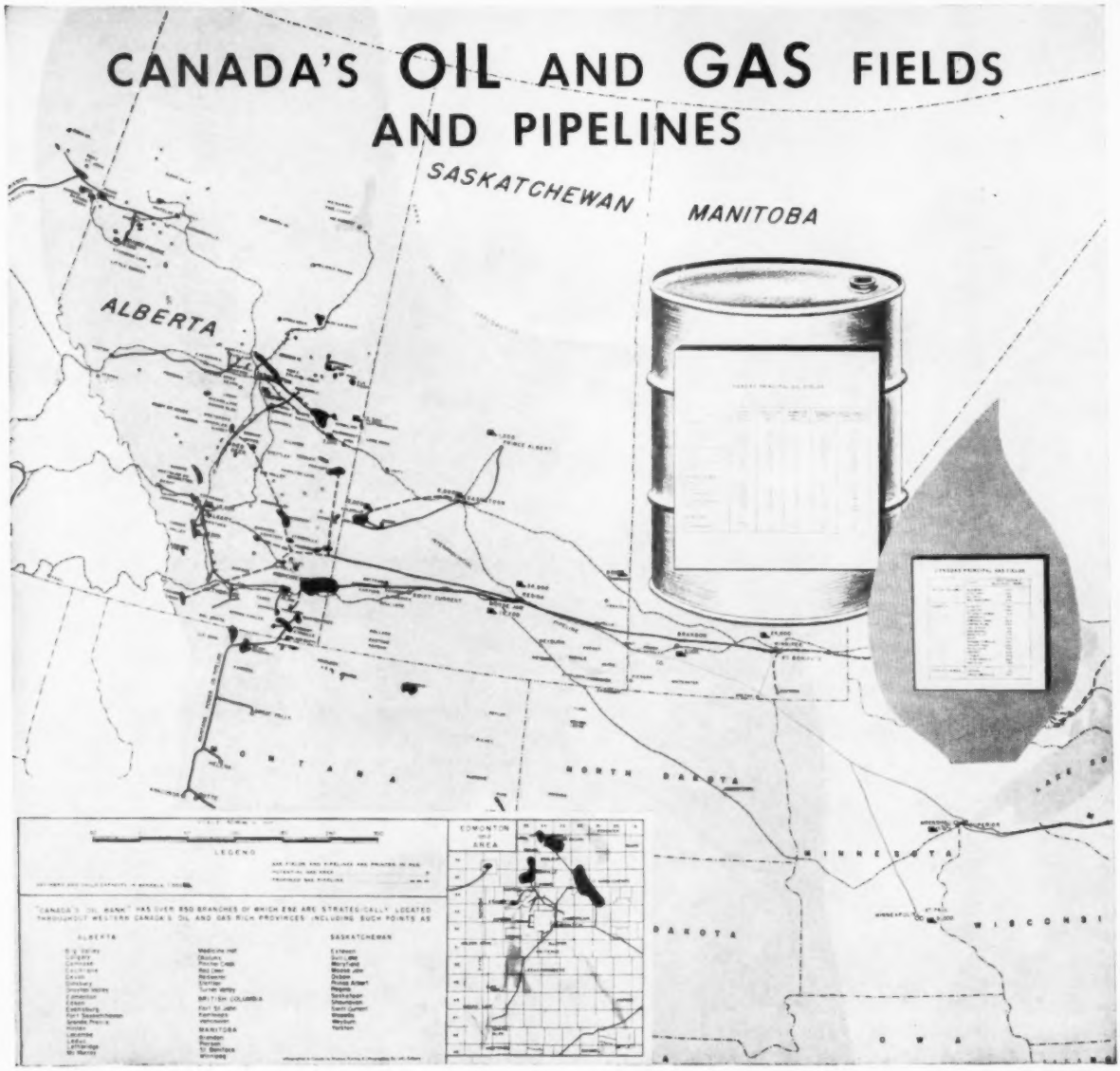
When all replacements and modifications were completed on the isolated section it was purged and repressured with line pressure of approximately 50 psi. The sealing elements of the Stopples were withdrawn and gas flow allowed to follow its normal course again.

While the city was supplied through the 4-in. by-pass line, continuous contact by radio and careful control of pressures were maintained between the regulator station and several vital points in the distribution system. The only inconvenience caused by this operation was temporary closing of King Hill road for ditching and winching equipment used at the job site (*Fig. 13*). It is doubtful that a single one of the 22,032 customers in St. Joseph had any idea that the only pipeline supplying gas to the city had been intentionally cut in two while the city operated on the 4-in. by-pass line for five hours.

A conception of the work done in one day (excluding excavating and welding) as described here is sufficient praise for the careful planning by management and efficient use of specialized modern equipment by the experienced men in the crew.

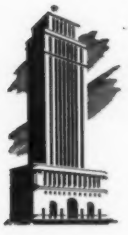
After the Stopples were removed from the closed BV valves, the tapping machine was again bolted to each of the gates respectively. For this operation a 16-in. Lock-O-Ring plug was attached to the tapping machine in place of the cutter. This plug with its O-ring seal was advanced through the opened valve to its proper position in the Lock-O-Ring flange of the split tee. After the plug was anchored in the flange as in *Fig. 14*, the tapping machine and valves were removed from the split tees, and blind flanges bolted on. The time required for this operation was about one and one-half hours.

This is just another example of the unacclaimed but dependable men who every day are using modern methods and equipment to better serve a public not often aware of the dramatic events taking place behind the scenes. ■



get this map of buried treasure!

Prepared by the Oil and Gas Department of the "Royal"—Canada's "Oil Bank"—this new map measures 43" x 23". Scaled 60 miles to the inch and lithographed in three colors, it shows Canada's principal gas fields and potential gas areas; gas pipelines, present and projected; oil fields, oil pipelines, and potential oil areas, with tables listing the principal oil and gas fields and marketable reserves. For a copy of this free map and a list of the Royal Bank's current "Oil and Gas Bulletins" write to: The Royal Bank of Canada, Oil and Gas Department, 409 8th Avenue, West, Calgary, Alta., Canada. These "Oil and Gas Bulletins" are revised by the bank as necessary and cover statistics, regulations, tariffs, oil and gas financing and kindred subjects. They are up-to-date and of practical value to anyone seriously interested in Canada's oil and gas industry.



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Money for replacements must be earned. Here the author, who is a consulting management engineer, offers some suggestions for

Replaciation during inflation

By B. A. MARGO • Montreal, Canada

THE gas industry like many others has a perpetual problem in maintaining its capital position during price inflation. With the exception of a few years, the trend of the purchasing power of the dollar expressed in terms of wholesale prices has been downward for about 60 years. *Table I* shows this trend for the period from 1935 to date. Accordingly replacements for all kinds of machinery and equipment normally cost substantially more than originally, a fact which can in many instances not be reconciled with permitted depreciation rates. This situation deserves a critical analysis and a fresh approach.

Fluctuating purchasing power

Although there exist many valid reasons to assume that the present downward trend mentioned will continue for a number of years, it is important to realize that this trend may eventually be reversed. In both instances the figures entered in books of account represent values which are not immediately comparable and the rates of depreciation permitted by the tax authorities may become more or less unrealistic. Consequently, the profits shown may be completely out of line. Accountants, economists and tax authorities are aware of this situation and industry seems to have obtained some relief through application of price indexes to inventory evaluation. However, this can at best be a partial solution to a much larger problem.

Therefore it is of interest to learn that there are a number of companies operating in different European countries which use a new system of fixed values which is described in *Canadian Business* of March 1957 under the heading "Moneyless Bookkeeping." This system is independent of the fluctuating purchasing power of money anywhere and gives management a reliable picture of operating efficiency and profitability.

Replacements and depreciation

The situation outlined above is aggravated by a considerable confusion caused by a misuse of the word "depreciation." The definition of this word is "the act of lessening value or worth, as of property," or "a fall in value." In actual practice, however, this word has a much broader meaning. Today industry expects the tax authorities to grant schedules of depreciation which will permit industry to write off enough money *to pay for replacements.* In a number of cases this has been accomplished by accelerated depreciation. However, in principle, depreciation was never intended to lay aside the money needed for replacements.

There does not exist any logical connection between the price of

GAS exclusive

TABLE 1. CONSUMERS' PRICE INDEX NUMBERS

(as published by the Bureau of Labor Statistics)

1—Basis 1935-39 = 100

Year	Index No.
1935	98.1
36	99.1
37	102.7
38	100.8
39	99.4
40	100.2
41	105.2
42	116.6
43	123.7
44	125.7
45	128.6
46	139.5
47	159.6
48	171.9
49	170.2
50	171.9
51	185.6
52	189.8
53	191.3

2—Basis 1947-49=100

Year	Index No.	
1954	114.8	191.9
55	114.5	191.7
56	116.2	194.5
57 Jan.	118.2	198.0
57 Feb.	118.7	198.2

Note: the numbers in the second column above are approximately correct for 1935-39 = 100.

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If you've got an underground corrosion problem, Galvomag® magnesium anodes are almost always the best solution.

Galvomag, the Dow high-potential anode that delivers 25% more current than conventional anodes, gives continuous protection to underground equipment—and it's easy on your maintenance budget. These more powerful anodes also provide extra punch and throwing power in high-resistivity soils. In normal soils they insure against corrosion with fewer anode units. Either way, you save on your original investment for cathodic protection.

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YOU CAN DEPEND ON DOW

TABLE 2. MAXIMUM OF RETURN

Column	1 ratio	2	3
	2.5:1	40%	14
	3.3:1	30	18
	4.0:1	25	21
	5.0:1	20	25
	6.6:1	15	33
	10.0:1	10	49
	20.0:1	5	95

an original investment and its replacement. The replacement may have substantially different technical features, e.g., one machine may replace two. Further, the nominal dollar amount paid for the original asset may pay for a fraction of the replacement only. Actually, we have two entirely different intentions and purposes, which, to avoid this confusion, should receive different names. Industry has to earn the money for replacements, an operation which poses various difficult problems as will be outlined later on. This phase of business may be called *"replaciation."*

In addition, industry wants to have a tax relief on the assets which it has already in its possession. This relief is justified by the fact that numerous assets—not all —experience a decreasing value expressed in dollars of the purchasing power of those dollars originally paid. For instance, a pump purchased in 1946 for $1000 may be worth about $100 today, measured in dollars of the same purchasing power, i.e., measured in 1946 dollars. (This would be about 140 1957 dollars.) Therefore, since the books of account are kept in nominal dollars only, the difference between $1000 and $140 should have been written off.

Even assuming that the depreciation schedules established by tax authorities are adequate for average conditions as far as life expectancy of assets is concerned, we have to recognize the fact that book values cannot be realistic if depreciation rates are used without consideration of the changing purchasing power of the dollar. Accordingly *profits and tax on profits* will be distorted, a situation which is extremely difficult to remedy under our present monetary system. Still, it should be emphasized that this problem is independent of the problems connected with replaciation. One thing has nothing to do with the other in principle.

Depreciation is a necessary feature of accounting for the reason outlined above. Replaciation is an optional feature of costing and pricing. The expression "optional" is used because not every asset has to be replaced; further, because it is entirely under the jurisdiction of management. Tax authorities have nothing to do with it or should have nothing to do with it. It is up to management to find the money for replacements which can be done either by borrowing new money or by earning the amounts needed by selling products or services.

In the latter case, replaciation charges may be included in the calculated selling prices. How to determine such charges will be explained later. The *calculated* prices including such charges may be "too high," which means that the *set* selling prices will be lower and will not permit to earn all the money needed for replacements. Consequently, if and when certain replacements will be needed, the money may have to be taken out of profits. If this happens, it may be considered as one of the numerous hazards of operating a business under the existing economic system. We should not forget that the ability of an enterprise to earn the money needed for replacements depends also on *other factors* as, e.g., volume of sales, which, in turn, may depend upon quality of products or services, advertising, etc. All this is surely no responsibility of tax authorities.

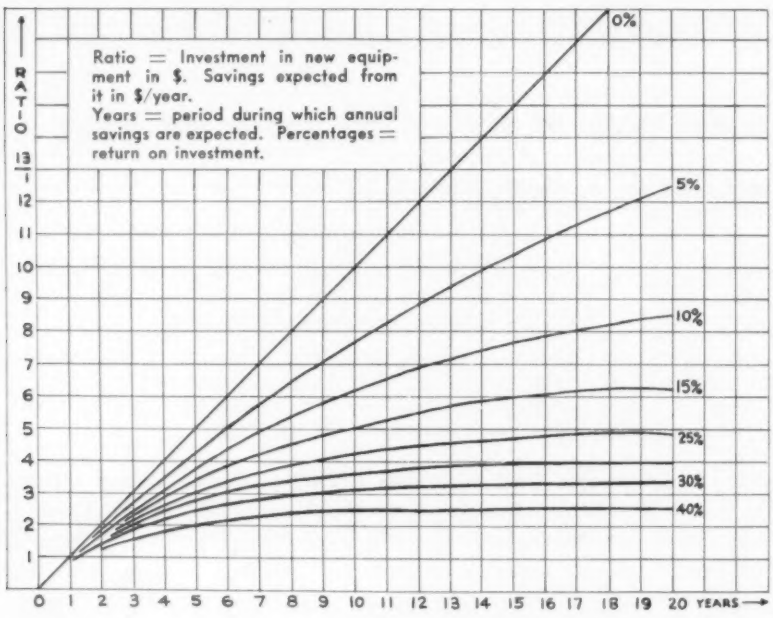


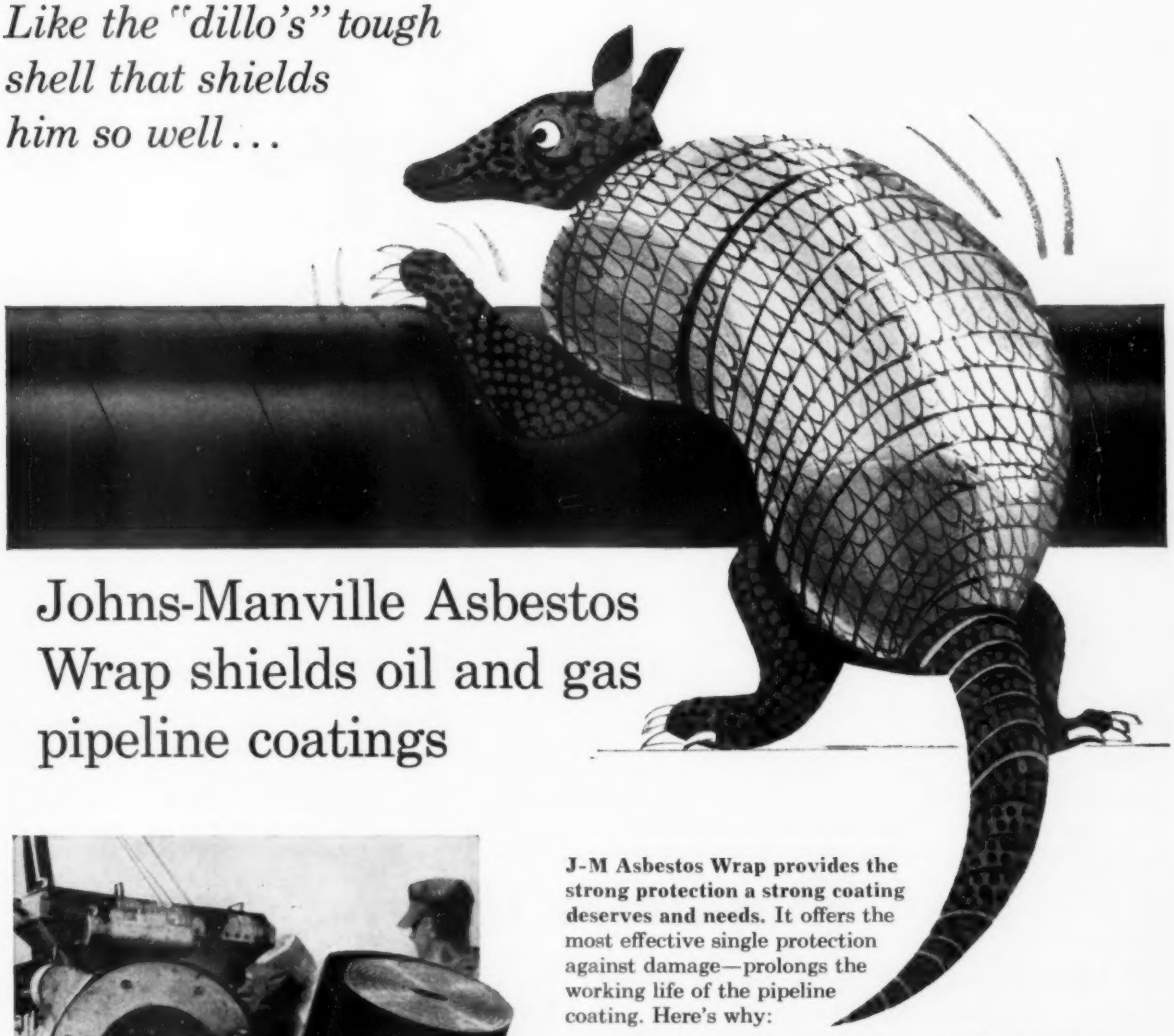
Fig 1.

How to figure replaciation charges

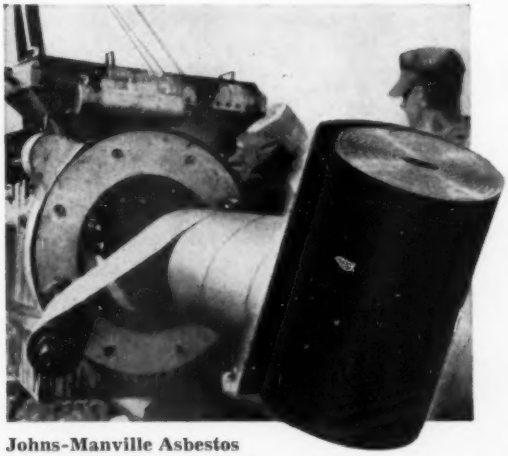
This is a task which may best be handled by a *cost accountant* who is familiar with operating conditions, preferably with some knowledge of engineering. Depending upon the magnitude of the company in question, this man may be an analyst who may need advice from the engineering and purchasing departments.

The approach of the cost accountant to his task will be different in several respects to the approach of an accountant. First of all, he will not be concerned with income tax and depreciation rates for income tax purposes. Further, he will have to verify for each asset whether it may have to be replaced at a later date. Numerous assets are bought for a once-occurring purpose only, e.g., experiments, which precludes their replacement. Consequently, for such items replaciation charges are not needed. In contrast, the accountant will take such items into the overhead or will treat them as capital expenditure depending upon the magnitude of the amount in ques-

Like the "dillo's" tough shell that shields him so well . . .



Johns-Manville Asbestos Wrap shields oil and gas pipeline coatings



Johns-Manville Asbestos Felt is available in 3 types for field application or mill wrapping:

#15 Asbestos Felt—the high-strength, uniform asbestos wrap that has given superior protection to pipe coatings for more than 30 years—under the most severe soil conditions.

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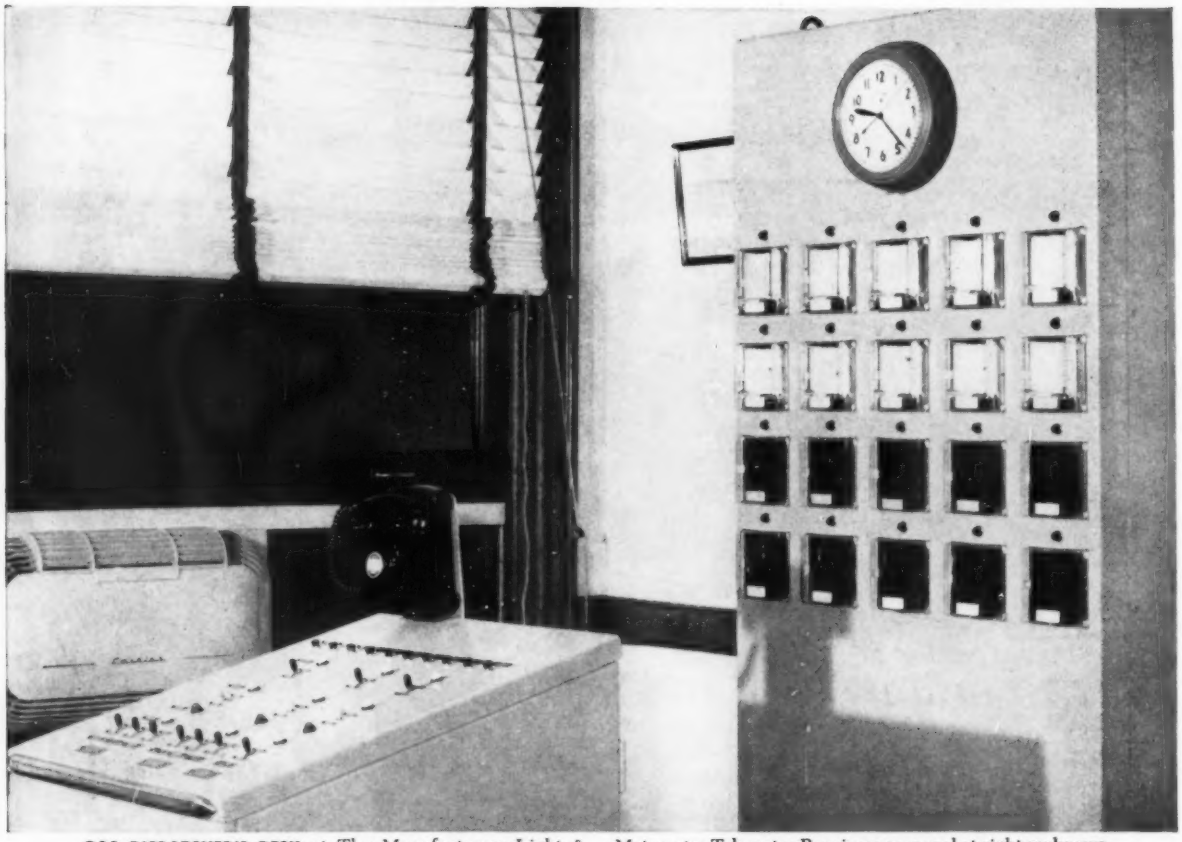

GAS DISPATCHER'S DESK at The Manufacturers Light & Heat Company's Pittsburgh office. The miniature Bristol Metameter Telemeter Receivers on panel at right make possible this ultra compact installation.

New miniature telemeters!

BRISTOL instruments make possible complete installation in small space.

Gas dispatcher at Manufacturers Light & Heat Co., Pittsburgh, Pa., does a full-sized job *in a fraction of usually required space.*

The miniature Bristol Metameter Telemeter Receivers in this highly integrated, compact station give the gas dispatcher eight continuous pressure readings from three remote regulator stations—from 7 to 30 miles away. Switches on the console let the dispatcher raise or lower the downstream pressure at any stations.

And all this in the office space taken up by two stenographer's desks!

Bristol Metameter® Telemeters—full-size or compact—can solve your remote measurement and automatic control problems as they have for hundreds of users in utilities, pipeline companies, and manufacturing industries. You'll find a Bristol system for every application: pressure, vacuum, liquid level, flow, temperature, static and differential pressure, motion, voltage, current, power and totalized load. For complete information write: The Bristol Company, 119 Bristol Road, Waterbury 20, Conn.

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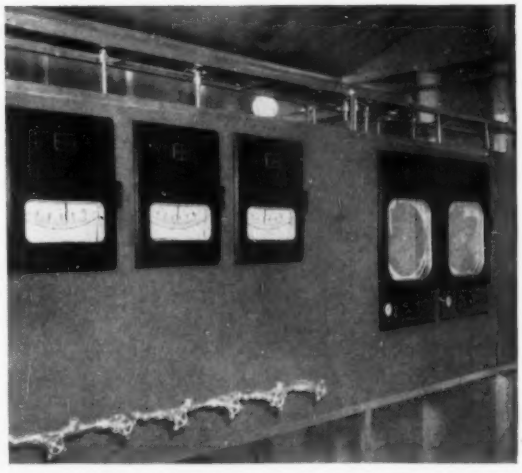


REMOTE REGULATOR STATION. Three Bristol Metameter transmitters (left) and two Bristol Series 500 pneumatic controllers transmit data to dispatcher—miles away—and automatically carry out his instructions.

BRISTOL *TRAIL-BLAZERS IN PROCESS AUTOMATION*

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

TABLE 3. WEIGHTED UTILIZATION FACTORS

Item	Investment	Estimated annual savings	Ratio	Service estim.	Life actual	Least No. of years for best return	Weighted Utilization Factor
	$	$/years		years	years	years	
1	75,000	30,000	2.5:1	7	5	14	0.268
2	300,000	45,000	6.6:1	12	15	33	1.362
3	12,000	3,000	4.0:1	9	3	21	0.017
4	50,000	10,000	5.0:1	8	15	25	0.300
Average	109,250	22,000				Average	0.486

tion and the financial situation of the business.

Finally, the cost accountant will have to use his own judgment when it comes to the question of dumping the cost of an item in the overhead or not. In principle, the money for anything that has to be replaced has to be earned, whether it is a perishable tool costing 50 cents or a small motor costing $50. On the other hand, it would not be practical to establish replaciation charges for a multitude of relatively small expenses. Still, the question remains where to draw the line. The simplest answer is possibly that a replacement charge should be worthwhile for every item that requires a history card to keep track of maintenance cost.

The two factors that determine replaciation charges are

1—The life expectancy of the item, i.e., the number of years up to its replacement.
2—the anticipated decrease of the purchasing power of the dollar during those years.

Life expectancy depends upon various factors, the more important ones of which are

1—operating conditions.
2—effectiveness of maintenance.
3—the liquidity of the business.
4—the attitude of management concerning taking of risks.
5—availability of improved machines, etc.
6—pressure of competition.

To estimate life expectancy with a tolerable degree of accuracy is obviously very difficult. For this reason, the new bench mark for control of this accuracy described later on may be found interesting.

The difficulty of estimating the trend of purchasing power of the dollar, on the other hand, is not as great as it may appear at first glance. It will be up to the cost accountant to watch this trend and he will have this phase under good control since he is at liberty to make adjustments on replaciation rates whenever needed.

The calculation of a replaciation rate may be explained by the following example: A company buys in 1957 a compressor for $15,000. The cost accountant assumes that it will have to be replaced in 1967, at which time it may have a salvage value of 10 per cent of its price in 1957. He further assumes that the general price level will be 30 per cent higher in 1967. (This is an assumption, not a prediction!) The amount to be collected during these 10 years is $15,000 minus 10 per cent = $13,500 (1957 dollars). The replaciation rate is 1.3 × $13,500 = $17,500 divided by 10 = $1750 annually.

These rates may be established for all assets that have to be replaced and may be added up for the different sections of a company. Thus management may obtain very valuable guidance when it comes to dealing with prices and rates. In contrast to depreciation, this phase of business is under complete control of management.

A new bench mark

Many machines and other pieces of equipment are replaced because of the savings expected from the new asset. These anticipated savings promise a certain return on investment which may be taken from a graph (see *Fig. 1*). For every ratio of investment to savings, a maximum of return can be reached after an infinite number of years. This maximum is shown in column 2 of *Table 2*. The least number of years required to reach this maximum, which is shown in column 3, has been calculated allowing a tolerance of 1 per cent in the calculation.

The figures shown in column 3, compared with the number of years of actual life of machines, etc., may be used as a bench mark in form of weighted utilization factors as listed in *Table 3*.

The weighted utilization factor is calculated as follows:

$$\frac{\text{Actual Service Life (years)}}{\text{Least No. of Years}} \times \frac{\text{Investment (\$)}}{100{,}000}$$

This weighing is necessary since otherwise an investment such as item No. 3 in *Table 3* with a relatively low dollar value could distort the whole picture.

A similar table, prepared at regular intervals, could be used to examine how individual investments fared, further, whether the average utilization factor as such is relatively high or low and, finally, whether there exists a trend of improvement or deterioration of the overall picture. If the situation deteriorates, an investigation may show that the fault lies with a lack of maintenance or an unforeseen trend of technological improvements which would deserve closer watching or other reasons.

Thus the table could help to improve the judgment of those who have to make recommendations and decisions regarding replacements. It would present a measure of the effectiveness of replacement policies which can be obtained at small expense. Such a measuring tool is desirable since replacement policy is a specific phase of a business which is not measured by its general profitability. A company can be profitable without having an effective replacement policy and vice versa. In other words, we have here a phase of business which deserves a special scrutiny and control with the viewpoint of improving operations. The method outlined above seems to be a tool of modern management which may be instrumental in accomplishing this with little extra effort. ■

A Texas Gas machinist devises a method of

Salvaging worn fuel injection valve bodies

WORN fuel injection valve bodies are being salvaged and reused through the ingenuity of a Texas Gas Transmission Corp. machinist.

At the Calvert City (Ky.) station, Machinist T. E. Fields devised a method of salvaging worn fuel injection valve bodies for Clark HBA-6 compressor engines by machining them to permit insertion of stem guide bushings. His method has already saved the company nearly $2200 and the end of savings is nowhere in sight. The savings could conceivably, through use and reuse of the salvage operation, amount to many times the present figure.

The series of events leading to Fields' development began more than a year ago.

Movement of rocker arms that control the operation of fuel injection valves was causing trouble. Valve stems were wearing stem guide bores—wearing them so excessively that the valves were moving out of center and not closing properly. When this happened regulation of fuel to the cylinders was affected, and in extreme cases gases were leaking into the valve bodies. Burning of the valves frequently resulted.

There were two methods of remedying the situation. One was to replace the fuel injection valve bodies, the other was to repair them. There were two drawbacks to making repairs, however. No one had ever done it, and no repair parts were available.

Machinist Fields felt that a salvage job could be done, however, and at much less cost than would be involved in purchasing new valve bodies.

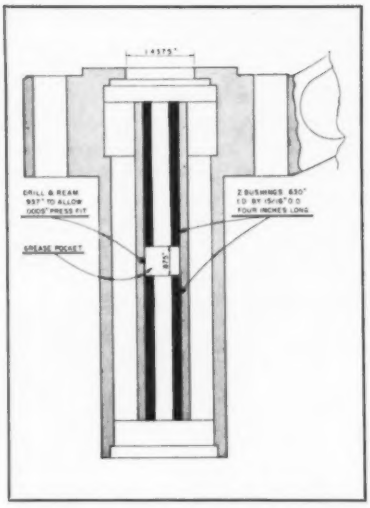
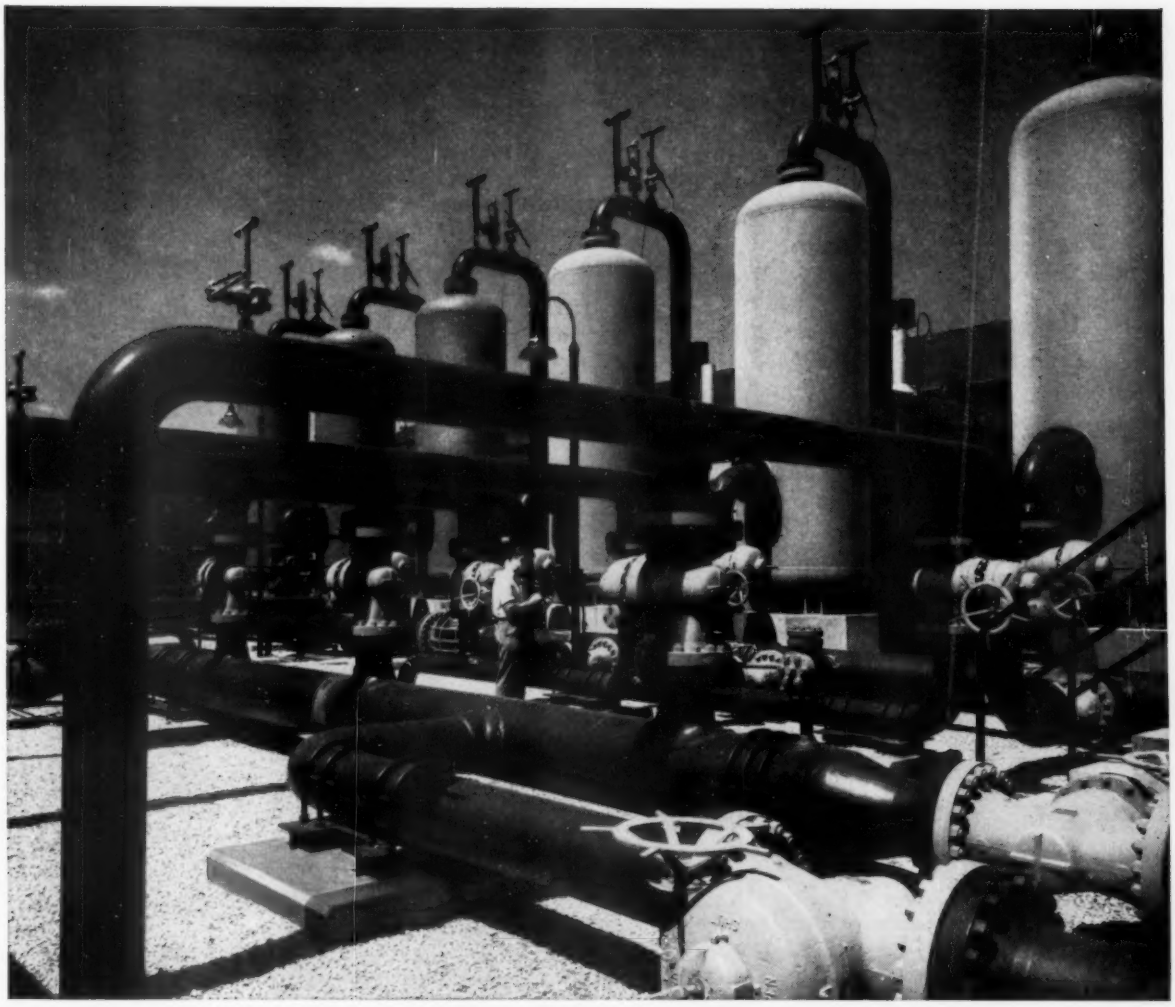


Fig. 1. Reworked valve body.

Using an especially devised jig to hold fuel injection valve body, Machinist Fields puts his lathe and his inventiveness to work. Result: salvage of a worn-out engine part.



Original station and expansion...

BOTH BY DRAVO

United Fuel Gas Company's compressor station at Lanham, West Virginia, was built by Dravo to route gas from the southwest for storage or for use in the eastern and northern markets.

Increased demands called for an addition to double the original capacity of the station. Three compressors, jacket water cooler, gas cooler and three gas scrubbers, together with the necessary building extension, were installed. The contract also included the fabrication and erection of all piping for the fuel gas, oil and water lines as well as for the gas lines.

Space limitations required compact design. The erection of new equipment and piping had to be accomplished without interrupting normal operation. Despite these handicaps, the addition was completed on schedule.

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The holding jig (left) is trued to within five 10,000ths of an inch before a valve body is mounted for reworking. Machining to very close tolerances (right) makes it possible for Texas Gas Machinist

Fields to use a press for the final operation—insertion of bushings in reworked fuel injection valve bodies. The operation has already proved itself a money-saver for the transmission company.

His experience as a machinist led him to believe that he could enlarge the old and worn valve guides by machining them, and that by inserting two bushings in the enlarged valve guides, he could make each body as good as new, or maybe even better. By using two bushings, he reasoned, he could leave a grease pocket between them (*Fig. 1*).

The original plan to make a bushing in the station machine shop was discarded when it was found that suitable bushings were available from a parts supplier.

Once the outside diameter of the bushings was determined, and even before they were delivered from the manufacturer, Fields set to work on the job of machining the worn valve guides. In order to do this accurately, he had to have a holding jig with which to mount the valve bodies on his lathe. He developed one especially for the purpose (*Fig. 2*).

The machining operation was slow at first. About 2½ days went into the complete reworking of a single valve assembly. However, machining was simplified to include running two successively larger drills (⅞-in. and 59/64-in.), making one boring cut, and running one 15/16-in. reamer that has been worked down by 5/10,000ths of an inch to give the hole its exact size and smooth finish. With this method, three valve bodies can be salvaged in a single day.

The bushing-insertion operation has also been simplified. Freezing the bushings and heating the bodies was tried for the original insertions. It was found, however, that because of a maximum bushing-to-hole tolerance of 1000th of an inch (minimum 7/10 of a thousandth), it is possible to snugly fit the bushings with a press.

A valve body is salvaged at a saving figured at $52. With six complete sets of six valve bodies salvaged and ready for use in case of emergency, the saving at Calvert City has amounted to $2184.

Taking into consideration that the original valve stem guide was of cast iron, and that the bushings used in making repairs are of steel, the repair job should be good for at least three times the anticipated life of a new cast-iron valve body. In addition, there is no apparent limit to the number of times new guide bushings can be placed in a valve body. When wear eventually makes bushing replacement necessary, it can be done simply by pressing out the old guide bushings and pressing in new ones. Fields estimates that this replacement operation will require about 15 minutes.

What does J. P. Owens, Calvert City station manager, think of the use of the salvaged parts?

"Six of our engines are operating with fuel injection valves equipped with stem guide bushings, and I feel that we can expect longer and more efficient valve life," he wrote in a station operating report. "Valve bodies formerly worn beyond practical reuse should now last indefinitely." ■

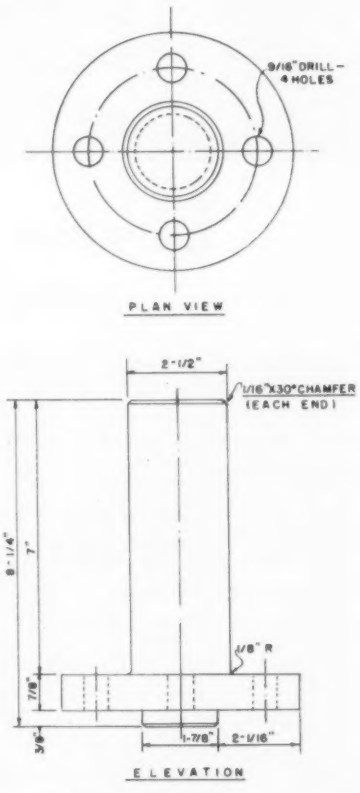

Fig. 2. Holding jig.

(Left) NO-OX-ID and NO-OX-IDized Wrapper application by Traveliner. (Right) NO-OX-ID kettle.

3-PIECE OUTFIT FOR WELL-DRESSED PIPE

This carrier pipe is being well dressed for years of uninterrupted service underground. A 3-piece outfit—cleaning machine, dope kettle and Traveliner—does the job.

The dressing? NO-OX-ID Coating and NO-OX-IDized Wrapper—a combination that provides chemical-mechanical protection against corrosion and destructive soil action. NO-OX-ID is applied hot or cold by hand or machine...over the ditch or at the mill. No noxious fumes. You save on material because less NO-OX-ID coats more pipe per day. NO-OX-ID Coating and Wrapper combinations shield against corrosion attack.

On your next transmission or distribution line coating job, consult with your Dearborn Pipeline Engineer. Ask him to recommend the NO-OX-ID combination best suited to your requirements. Cost is reasonable and the protection long lasting. The best dressed pipe is NO-OX-ID PROTECTED!

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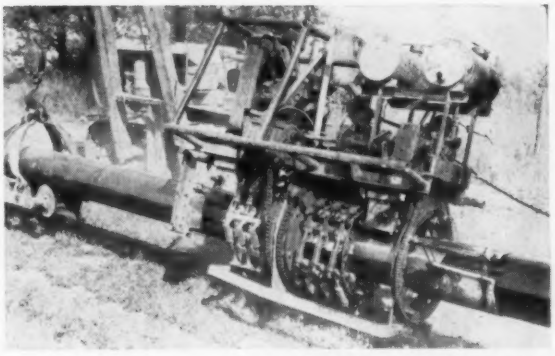

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GAS pipeline news

Supply contract signed for Canada-Calif. line

Following formation of the Alberta & Southern Gas Co. (see following story), the company signed a $100 million contract with Shell Oil Co. for a substantial part of the large-volume natural gas reserves required for the Canada-to-California line.

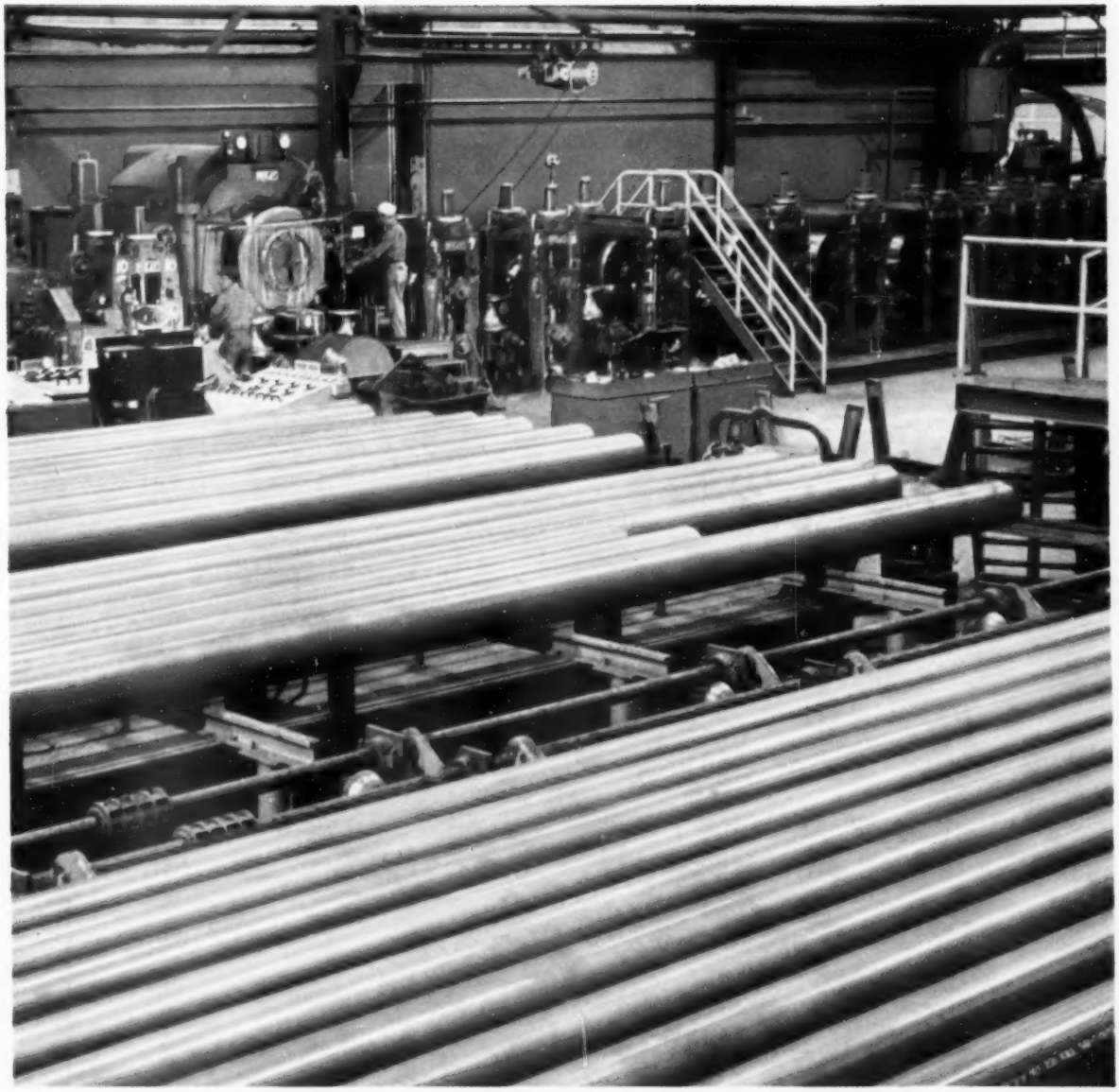
The arrangement will result in payment of more than $100 million to Shell during the first 10 years of gas delivery. Of this total it is estimated that approximately $15 million will be paid to the Alberta provincial government in gas royalties.

Alberta & Southern will purchase the gas for Pacific Gas & Electric, San Francisco.

Shell's vice president, Paul L. Kartzke, estimates his company will be able to supply 200 MMcf/day to the proposed 1300-mile, multi-million dollar transmission system. Four major natural gas fields in which Shell and Canadian Shell Explorations Ltd. have holdings are involved. These fields are located in the Waterton area at Sarcee, 15 miles southwest of Calgary; Crossfield, 20 miles north of Calgary; and the Homeglen-Rimbey field, 60 miles south of Edmonton.

The arrangement calls for Shell to sell to Alberta & Southern all its gas supplies in these four fields. In addition, Shell has agreed to sell to the newly organized company any gas which is discovered by it in the next 10 years in southwestern Alberta—up to a total of 5 trillion cu ft.

Jack K. Horton, president of A&S, said the arrangement with Shell is the first of a series now being made with Alberta gas producers. The contracts, he said, will result in an additional expenditure by producers of between $150 million and $200 million for well development and processing facilities



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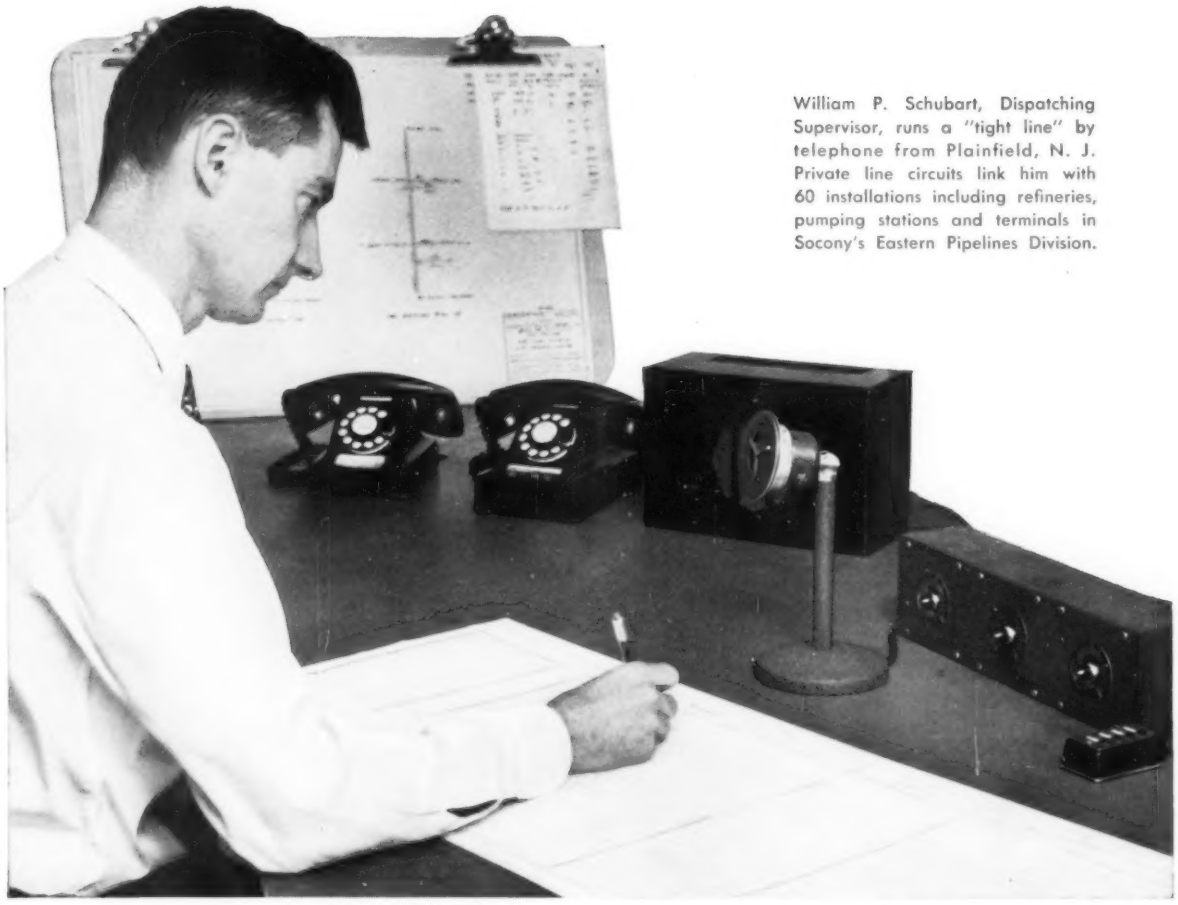

William P. Schubart, Dispatching Supervisor, runs a "tight line" by telephone from Plainfield, N. J. Private line circuits link him with 60 installations including refineries, pumping stations and terminals in Socony's Eastern Pipelines Division.

He's keeping track of 40 batches by private line telephone service

Using Bell System private line telephone service, the Plainfield, N.J., dispatcher of Socony Mobil Oil Company keeps multi-product traffic flowing through three different pipeline systems. Up to 40 batches of different products are en route at the same time.

The dispatcher relies on the telephone (1) to instruct gaugers at delivery points, (2) to keep all products moving at a proper rate, and (3) to verify the volume of each batch at check points in the line.

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alone within the Province of Alberta.

Construction of the Alberta-California line will get under way as soon as formal clearances have been obtained from the Alberta Oil & Gas Conservation Board, the Canadian Board of Transport Commissioners at Ottawa, the U. S. Federal Power Commission, and the California Public Utilities Commission. Present plans schedule the project to go into operation late in 1960 with initial deliveries of 400 MMcf/day.

PG&E, Bechtel, Canadians organize new gas company

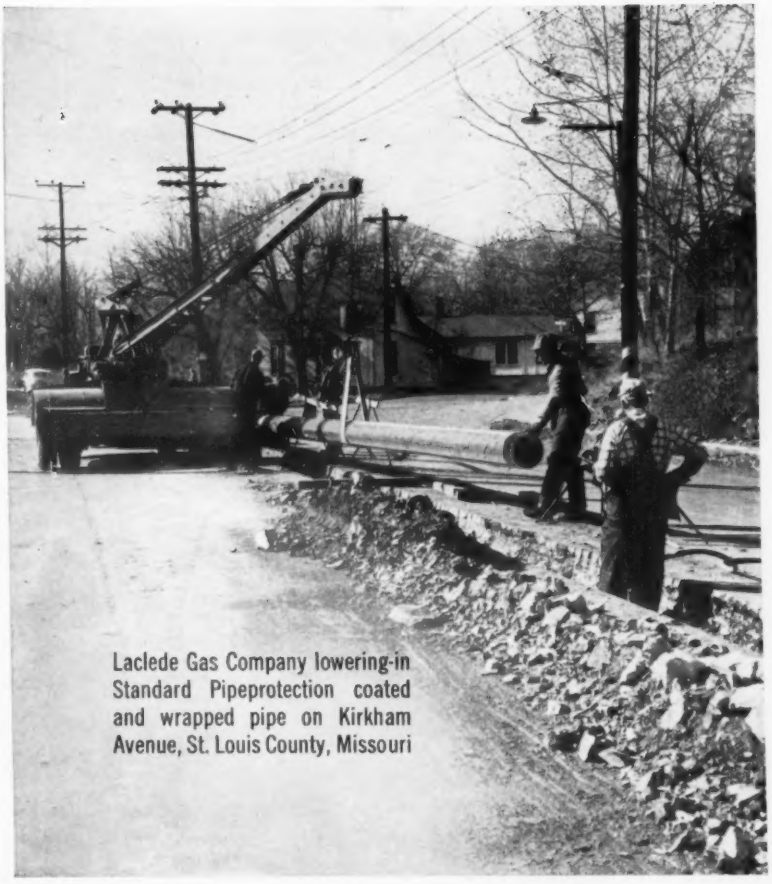
Pacific Gas & Electric Co. and Bechtel Corp. have formed Alberta & Southern Gas Co. Ltd. to buy surplus Canadian gas for the California market (see GAS, August, p. 8).

Organization of the company is the first major step in the recently announced plans for a $330 million project to augment California's gas supplies with Canadian gas, beginning in 1960.

President and chief executive officer of Alberta & Southern is Jack K. Horton, vice president of PG&E. Six Americans and seven Canadians make up the board. In addition to President Horton, they are: James B. Black, chairman of the board of PG&E and chairman of the new company; S. M. Blair, president of Canadian Bechtel, newly named vice chairman of Alberta & Southern; N. R. Sutherland, president and general manager of PG&E; R. H. Gerdes, J. S. Moulton, and P. E. Beckman, all PG&E vice presidents; Ross MacKimmie, J. E. A. MacLeod, C. O. Nickle, and R. L. Winton, all of Calgary; and H. R. Milner and D. K. Yorath, both of Edmonton.

Mr. Horton is moving from San Francisco to Calgary, where the company will have its offices.

A&S representatives are now engaged in negotiating contracts with producers in the Canadian fields for the 400 MMcf/day it proposes to deliver to the San Francisco Bay area. Covering a 1300-mile distance, the line will originate in the Alberta foothills and follow a route west of Calgary—spanning the Canadian Rockies at Crowsnest Pass—and traversing portions of Idaho, Washington, Oregon, and northern California, before it



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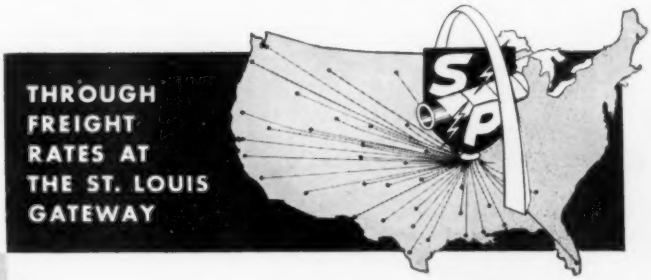

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terminates at PG&E's station at Antioch.

Phillips decision to have "first real court test"

Did the Supreme Court intend to place small independent producers under federal control when it made its historic Phillips decision? That question will be answered in the "first real court test" of the decision, which will take place in the 10th Circuit Court of Appeals in Denver.

Independent oil and gas producers' associations in five principal gas producing and exporting states have joined in filing an *amicus curiae* (friend of the court) brief asserting that the Phillips decision included only integrated companies like Phillips and that FPC regulation should be limited to gas sales made "after production and gathering have ended." Associations in Texas, Oklahoma, Kansas, Louisiana, and Mexico are involved.

The test case is Saturn Oil & Gas Co. vs FPC. According to the associations, no other case has yet been before the courts which distinguishes the position of the "true, unintegrated independent" producer from the Phillips case. Should Saturn be declared not subject to FPC jurisdiction, the result would be a victory for thousands of small gas producers far more sweeping than passage of the vetoed Harris-Fulbright bill or the now pending Harris bill.

Producers believe the Saturn case is "near ideal" for setting out the differences between operations of independents and "natural gas companies."

Saturn, a small Kansas company engaged only in gas production, is said to differ from Phillips primarily in that: (1) its sales occur at the wellhead; (2) Phillips processes gas for resale to pipelines, while Saturn does not; and (3) Phillips in some instances transports gas across state lines en route to the processing plant.

The producers contend that Saturn is not subject to FPC regulation because its operations "bear no resemblance whatever to Phillips, nor do the operations of thousands of other small, unintegrated producers selling gas at the wellhead, whose economic fate may well hinge on this case."

The Supreme Court, the brief states, was careful to point out that Phillips was a large integrated company and that production and gathering ended before sales by Phillips occurred. The Natural Gas Act exempts from FPC regulation the "production and gathering of natural gas."

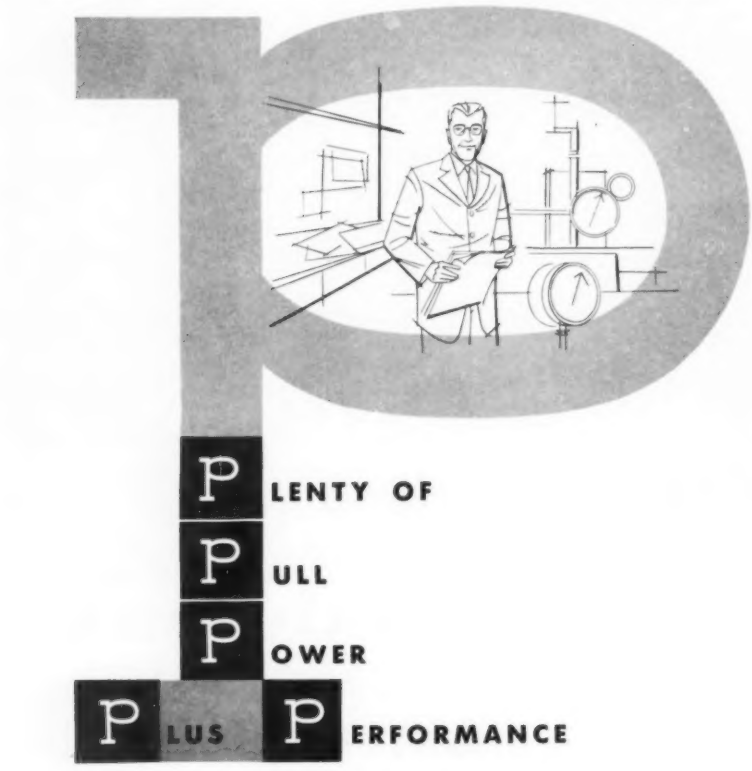
Jerome J. O'Brien, TIPRO president, terms the filing "one of the most important undertakings of our association."

"It could bring a significant measure of relief from what we hope and trust was an unintended imposition of chaotic federal control," he said.

The brief warns of the "cataclysmic collision" of state and federal powers if all independent producers are held subject to regulation of the type the FPC seeks to impose on them under the Phillips ruling.

PNW seeks 17% rate boost; customers protest

Pacific Northwest Pipeline Corp.'s plan to increase its rates by $5.5 million has brought a storm



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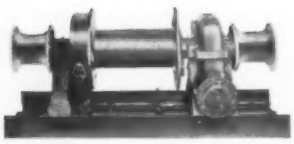

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The biggest mistake is the one you can't see!

As an experienced pipeline man, you'll have little trouble spotting four obvious "errors" in this picture*. But the *biggest* and most *costly* error you can make in pipeline construction is to gamble on unproven or "economy" types of pipeline protection.

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*Operating from left side of ditch; man standing on line; man in ditch under line traveling machine; loop in "Hoosier" pole.

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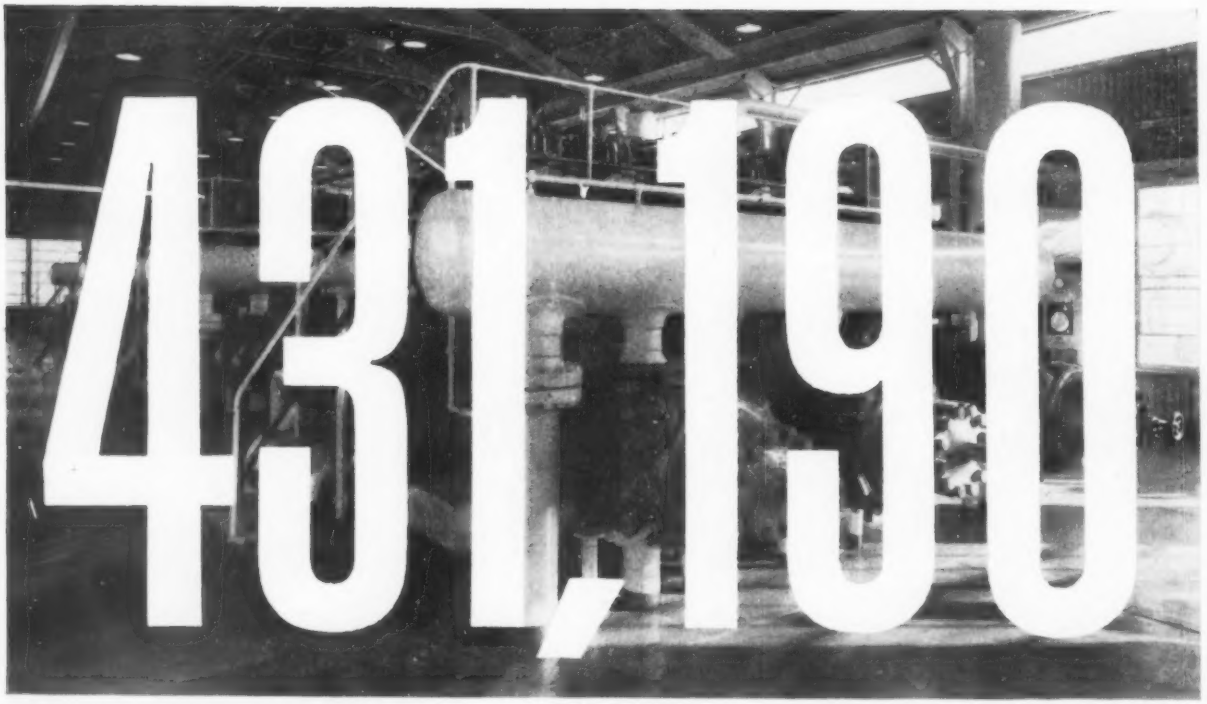
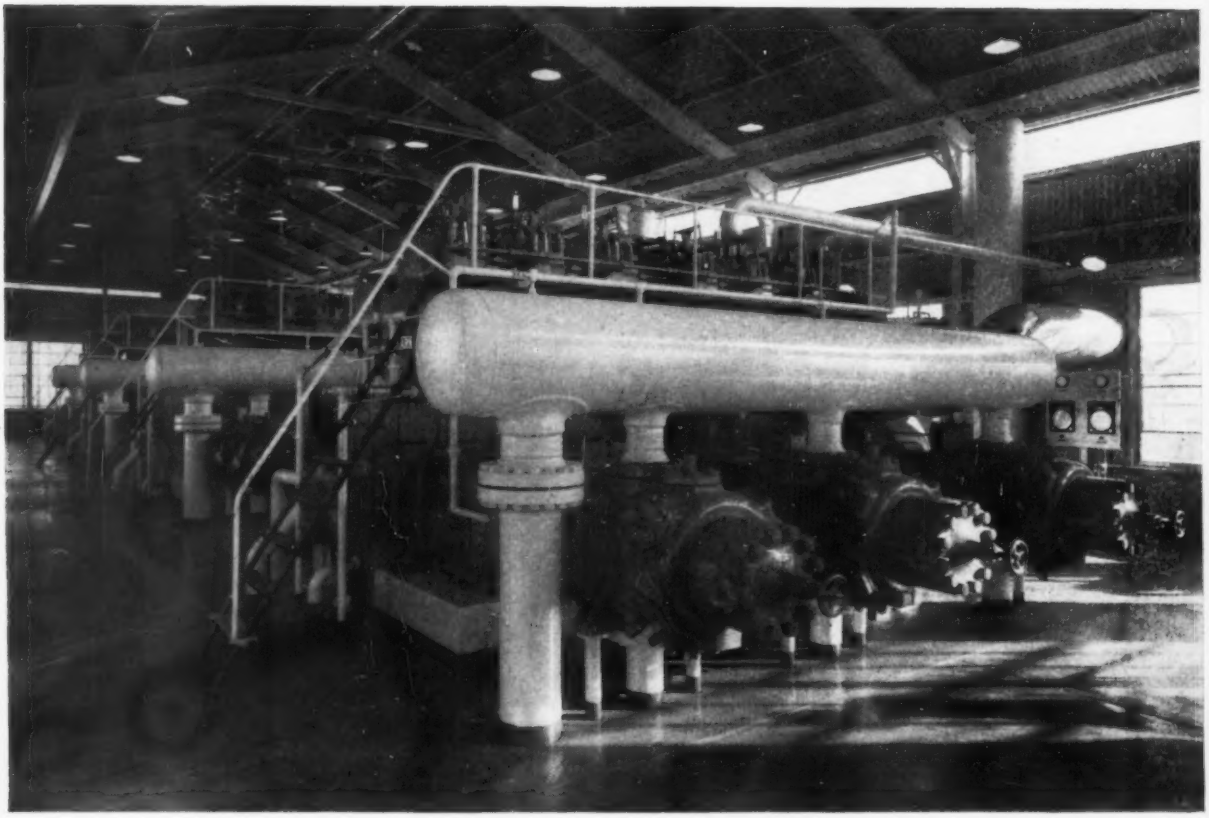


HORSE



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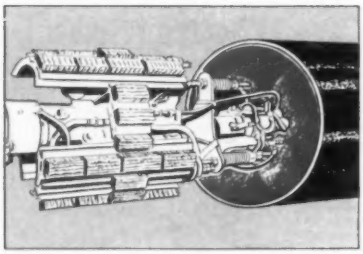
Copon internal pipe coating selected again by major gas transmission company



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of protests. Twenty six wholesale customers and other pipelines in Washington, Oregon, Idaho, Wyoming, Utah and Colorado as well as in Canada would be affected by the 17 per cent hike.

In supporting of its filing, Pacific cited present operating costs generally higher than those estimated when the company made its certificate application in 1953. Several months' operational experience, it said, has shown the need for the higher rates.

According to Canadian reports, the proposal may provoke a government review of all export and import permits for natural gas. Pacific Northwest is supplying gas to the Vancouver area until Westcoast gas gets there. (Westcoast Transmission completed its line recently.) However, PNW has a 20-year contract to supply Trail, B. C.

In Washington, the Association of Washington Gas Utilities "commends the Washington Public Service Commission for its immediate and vigorous opposition to the proposed increase . . ." Members of the association are Cascade Natural Gas, Pacific Natural, Portland Gas & Coke, Spokane Natural, and Washington Natural.

Charles M. Sturkey, president of Washington Natural, said the request came "as a shock to the management . . ." He believes that the request is premature. "This is the development period and our experience to date indicates gas sales are gathering such momentum that the pipeline will receive ample revenues for its requirements by early spring of 1958."

Washington State okays Pacific Gas Transmission

Pacific Gas Transmission Co. of San Francisco has qualified with the Secretary of State to do business in Washington state.

This company is a new subsidiary of Pacific Gas & Electric Co. and presumably has been formed in connection with the new line from Canada. E. E. Manhard, who is secretary of PG&E and Standard Pacific Gas Line Inc. (jointly owned by PG&E and Standard Oil Co. of California), is secretary of the new company. Gilbert L. Harrick is president.

Pacific Gas & Electric's proposed line from Alberta to California would run through eastern Washington and Oregon.

Independents protest FPC's financial data plan

Four independent producers' associations are protesting FPC's plan to have independent gas producers file extensive financial data on both interstate and intrastate sales and sources of income other than gas sales.

The proposed rule would require independents to file "balance sheets showing all principal accounts" and a "statement of income for the year ended Dec. 31, 1956, which sets forth . . . the respective kinds of revenues or income for the year, including the gross revenues from all sales of natural gas."

John Davenport, general counsel of TIPRO, filed the brief on behalf of the producers groups. It protested the FPC ruling on seven grounds: (1) The reporting procedures are unfair and unreasonable; (2) they are unnecessary; (3) they require information out-

Continued on page 184

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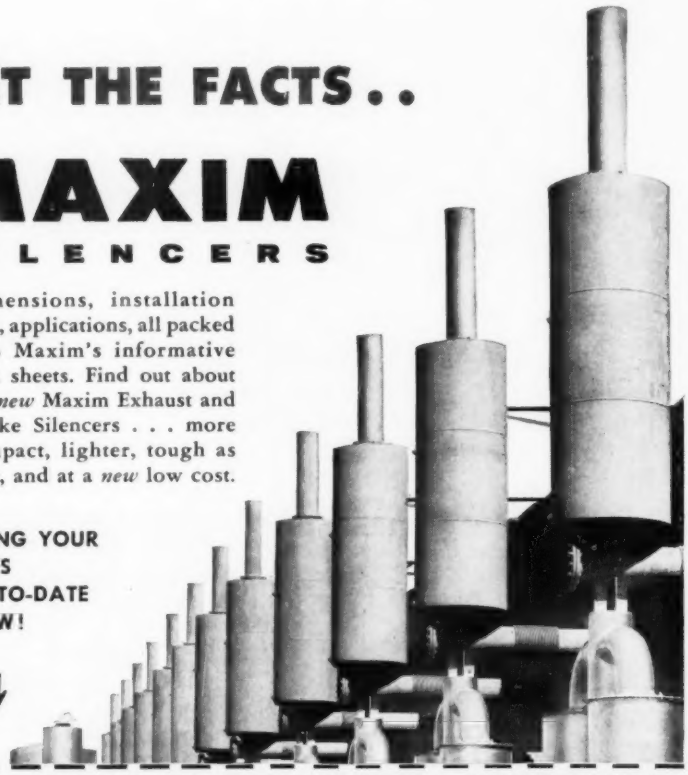

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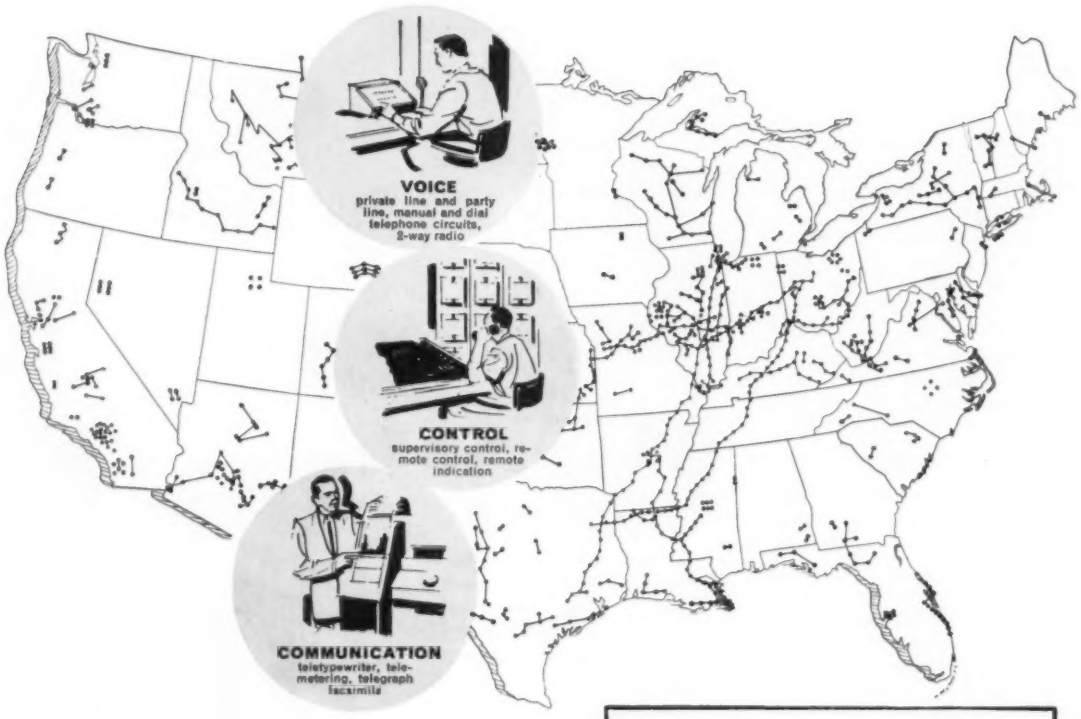
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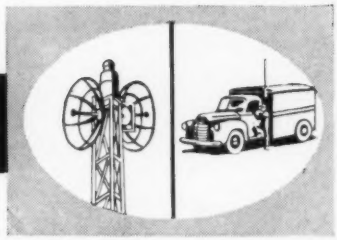


By FRANK CHAPMAN

NCUR and steering committee plan comments on FCC proposals

THE executive council of the National Committee for Utilities Radio and its reallocation steering committee met in Washington recently to discuss comments for submission to the Federal Power Commission on proposals made by the commission in Dockets 11990, 11991, and 11997.

In Docket 11991 the commission proposes various amendments to Part 11 of its rules. NCUR's comments, among other things, will oppose an amendment which specifies that the use of any frequency may be restricted as to hours of operation. The essential nature of power utility operations requires that they operate day and night.

In comments on this same docket, NCUR will urge that all channels in the 152-162-mc band, made available by reducing the spacing of channels now allocated to the Power Radio Service, should be allocated to that service. The committee will oppose the proposal included among the amendments described in Docket 11991 to make the communication common carriers eligible in the Power Radio Service and suggest an alternative solution to satisfy the admitted requirement of the communication common carriers for stations to be used in the construction and maintenance of their common carrier plants.

In regard to Docket 11990, which describes proposed amendments in Part 10 of the rules, NCUR believes that the proposed amendment to Part 10, which would establish a new local government service, if adopted, would help somewhat in relieving some of the congestion that now exists in the Power Radio Service, although it will not completely relieve that serious congestion.

In connection with comments on Docket 11997, which concerns allocation of certain frequencies in the radio spectrum to various nongovernmental services, NCUR estimates that 10 years from now the number of channel assignments to licensees in the Power Radio Service will be more than two and a half times the present number, if the eligibility in that service remains as it is under the present rules. Of the new total it is believed about 20 per cent could be assignments in the 450-46-mc band while the remaining 80 per cent would be divided between the 30-50-mc and the 152-162-mc bands. It is conservatively estimated that an increase to two and a half times the number presently allocated frequencies in the latter two bands would be required to permit satisfactory operation of the systems to which the assignments are made. A suitable number of exclusive pairs of frequencies in the 450-460-mc band will also be required.

In general, the questions posed by the commission in this docket are so searching and so broad in their coverage that detailed and voluminous replies and comments will be necessary.

Observers forecast FCC will sanction continued use of private microwave

Final phase of the public hearings on the future allocation of microwave frequencies comes to an end before the Federal Communications Commission in October with the groundwork pretty well laid for restricted use of the bands above 890 mc.

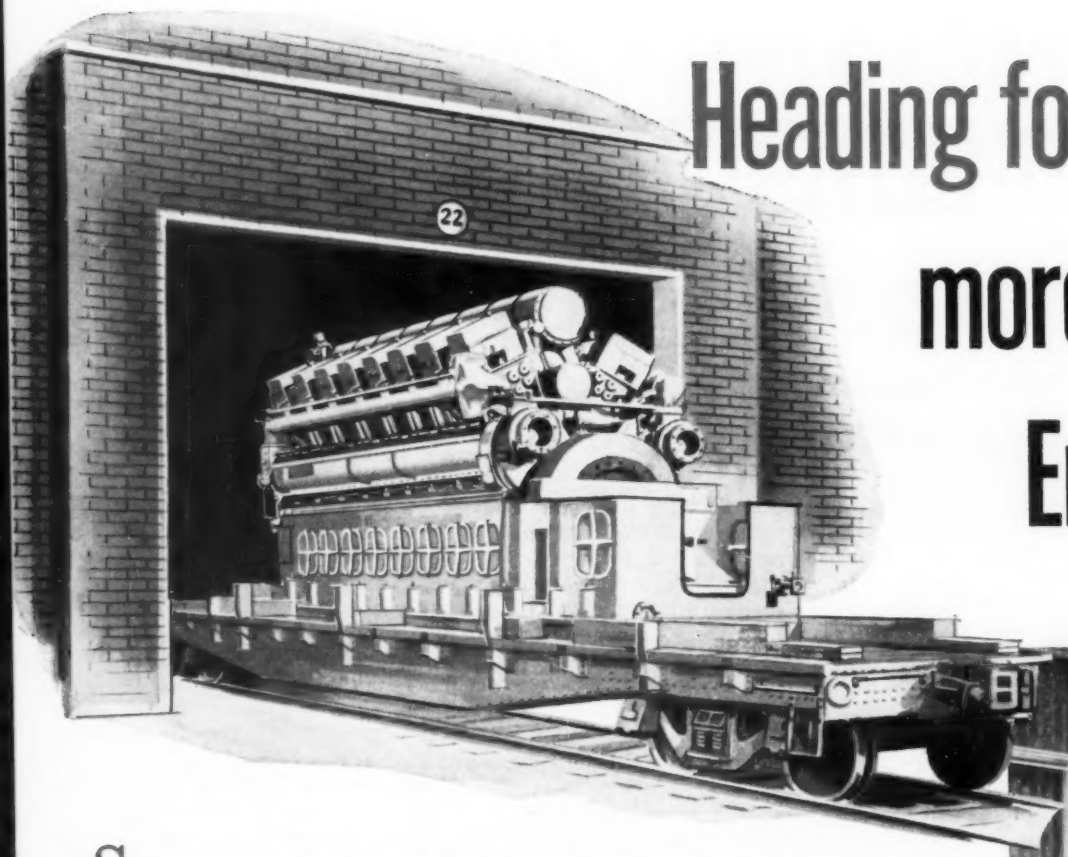
While the commission is expected to take several months to review the thousands of pages of testimony, most observers are betting that the final outcome will see continued use of private microwave facilities by the oil and gas industry and others now eligible for licenses, but tight restrictions on entry of new industries.

It's also expected that the new policies to be laid down by the FCC covering microwave bands will restrict somewhat the types of uses to which licensed operators will be permitted to put their facilities.

Staff officials of the FCC expect the commission to issue a report setting down the general policies to be followed in issuing microwave licenses. The individual service divisions of the FCC will then follow up by issuing a series of rules to carry out these policies. In most cases, the rules will not be subject to extensive public hearings.

The commission is now at full seven-man strength. Frederick W. Ford, former U. S. Assistant Deputy Attorney General and one-time staff employee of the FCC, has taken a seat on the commission. He replaces former FCC Chairman George C. McConnaughey, who declined reappointment when his term expired this summer.

Heading for low more and Engine



Shipments of Nordberg Supairthermal® Gas Engines with integral gears for compressor service emphasize the increasing application of these highly efficient prime movers by major gas transmission companies.

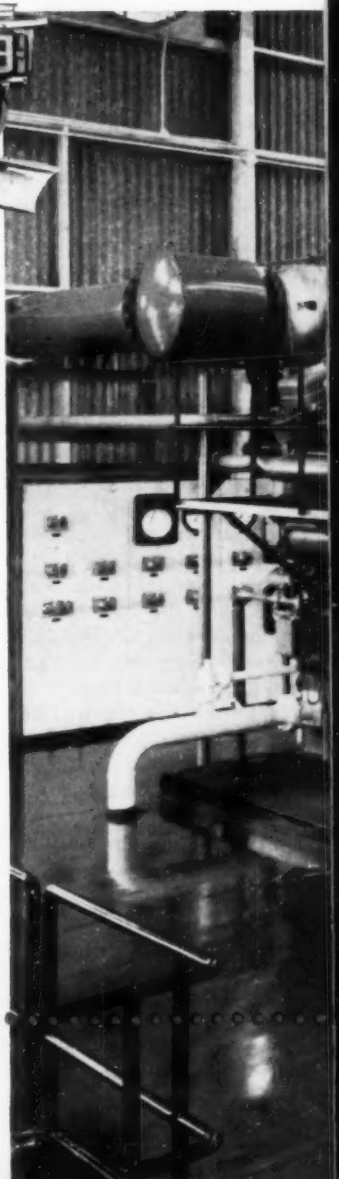
Advantages of Supairthermal gas engine-gear sets are summarized as follows:

(1) Lower cost per installed horsepower; (2) Lower operating cost; which results in (3) Lower transmission cost.

(4) Ability to handle variations in volume and compression ratios with high efficiency at variable speeds.

(5) Adapability to remote-automatic operation.

Nordberg engines are, by all standards, your best investment in economical, long term pipe line power. Chances are, you too will benefit by using Nordberg engines on your next pipeline expansion program. Write for further information.



NORDBERG

DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

Q457

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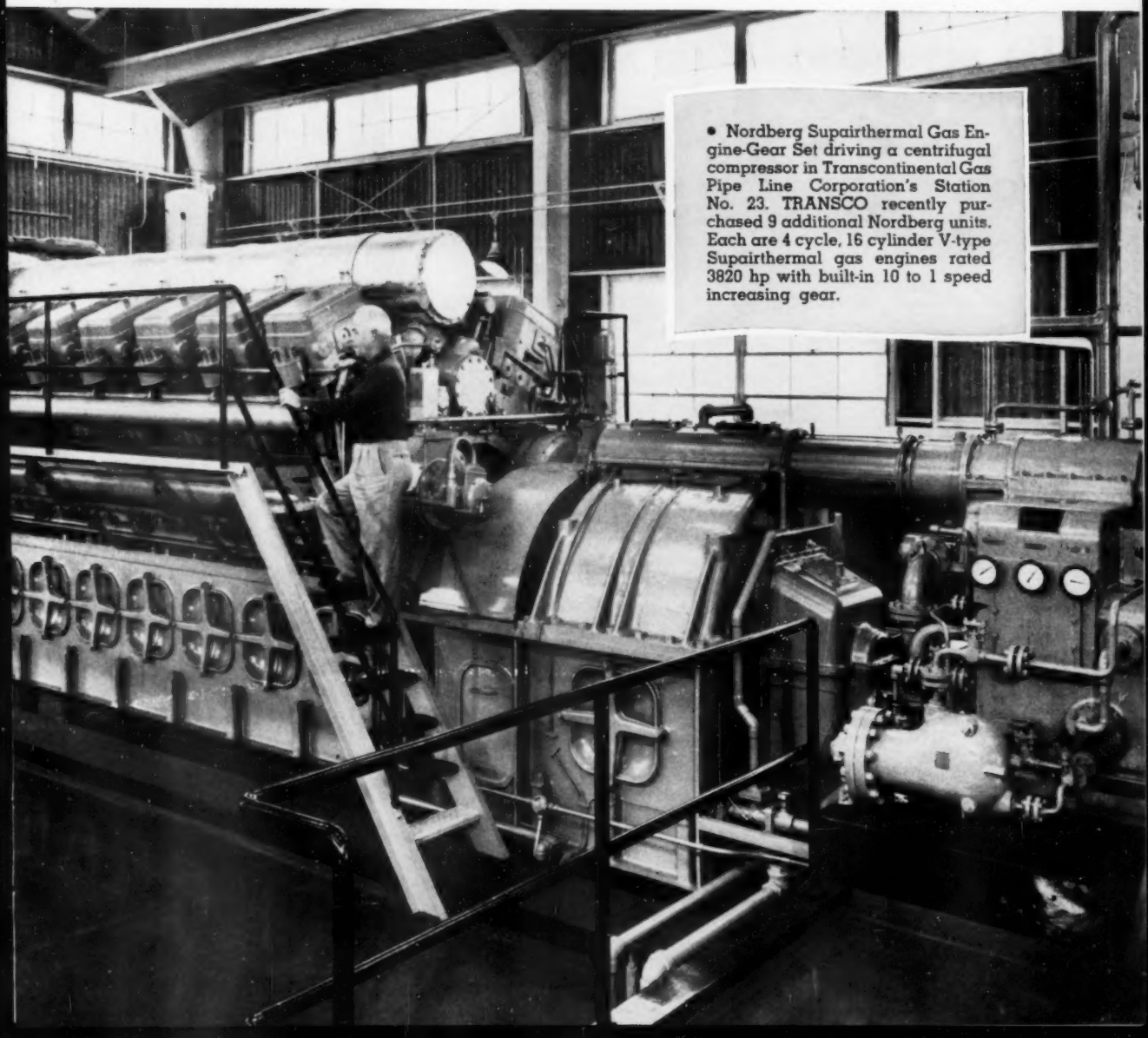
NORDBERG MFG. CO., Milwaukee, Wisconsin

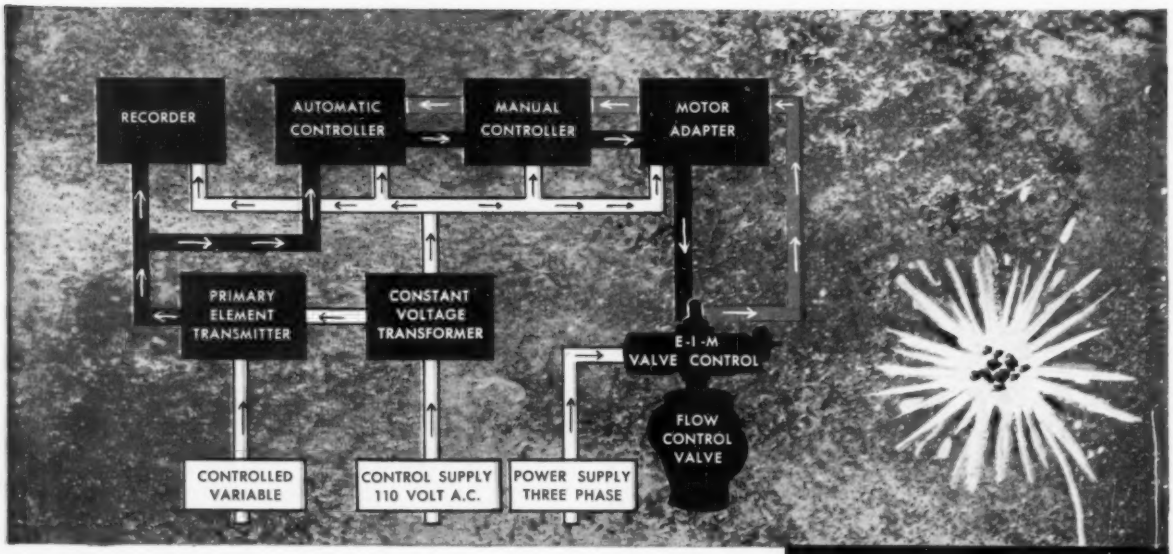
Gas Pipe Line Transmission Costs...

more NORDBERG

Centrifugal Gas Compressor Sets



• Nordberg Supairthermal Gas Engine-Gear Set driving a centrifugal compressor in Transcontinental Gas Pipe Line Corporation's Station No. 23. TRANSCO recently purchased 9 additional Nordberg units. Each are 4 cycle, 16 cylinder V-type Supairthermal gas engines rated 3820 hp with built-in 10 to 1 speed increasing gear.



The valve control of the future TODAY

EIM
FUTRONIC
VALVE CONTROL

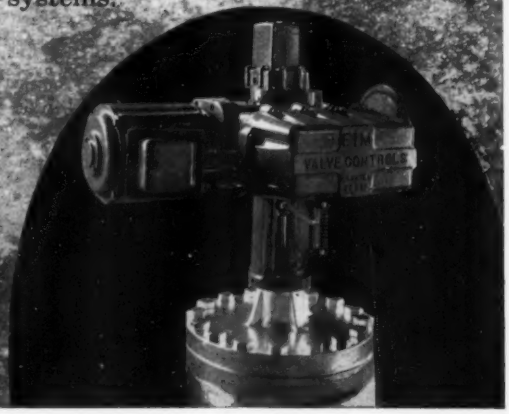
E-I-M FUTRONIC valve control, the first all electric power operator for actuating control valves in throttling and regulating services.

The fully flexible electronic control system, utilizing A.C., D.C., motion inputs as well as conventional primary elements, is highly suitable for process and power instrumentation.

The FUTRONIC valve control system, is particularly valuable in meeting pipe line compressor station, pipe line pumping station and metering station requirements.

Units are adaptable for readout, cascading, computer and similar systems. Transmission distances of great length are permissible and it is possible to tie in with leased wire, micro-wave and other metering systems.

For complete details of the FUTRONIC valve control write



E-I-M
COMPANY, INCORPORATED
1340 Old Spanish Trail
Houston 25, Texas

from page 25

pipe is exposed to conditions different from those indicated by our surveys; and (2) the correlation between resistivity and corrosiveness is made more uncertain by the inaccuracy of our measurements.

As in most of the corrosion engineer's work, this problem can only be approached by approximations, by simplifying assumptions. *Fig. 1* shows the effect upon the indicated or apparent resistivity (ρ_a) of the presence of a non-conducting layer at various depths. The abscissae are depths to the non-conductive layer, expressed in units of the electrode spacing used; the ordinates are the correction factors, expressed as the ratio between the resistivity of the surface layer (ρ_s) and the apparent resistivity (ρ_a). The lower part of the curve is essentially a straight line (it is, for very small values of d/a, asymptotic to a straight line). This means that, for very thin surface layers, the value of R indicated by the instrumentation is independent of the electrode spacing; for very deep layers, R is inversely proportional to the electrode spacing.

Fig. 2 is based on this latter relationship, and shows the depth of the non-conductive layer as a function of the ratio R_2/R_1; the ratio between the two resistance values (not resistivity) obtained with two electrode spacings whose ratio is 2/1. The depth is given in units of the *smaller* of the two spacings.

These two curves can be used together to determine both the depth of the surface layer and its resistivity. (It must be remembered that the results are true only when the lower layer is non-conductive and the upper layer is uniform, and both are horizontal planes; otherwise the corrected values are approximations.) However, the corrected resistivity can be determined directly from *Fig. 3*, which shows the correction factor as a function of the measured resistances at two electrode spacings with a 2/1 ratio. The method of use is as follows:

(1) Measure R in ohms at two electrode spacings whose ratio is 2/1 (for example, 125 in. and 62½ in.) (Note—R is directly indicated by such instruments as the Megger and the Vibroground; it is the ratio E/I, E beng measured at the two inner electrodes and I at the outer pair.)

(2) Express the ratio of these two readings as R_2/R_1.

(3) From *Fig. 3*, determine the factor corresponding to this value.

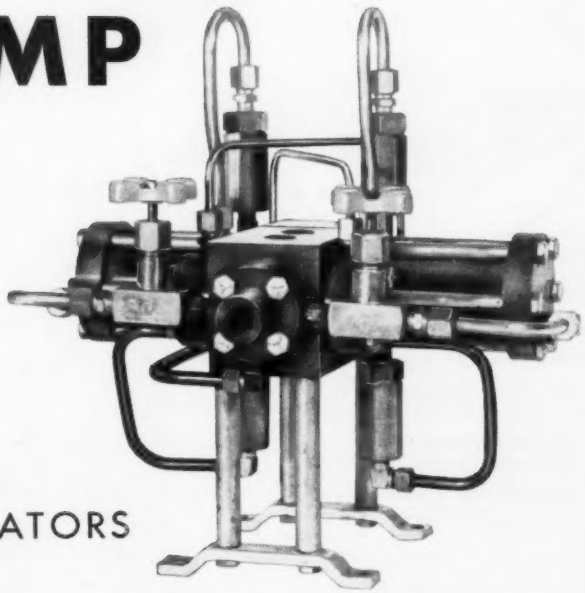
(4) Multiply R_1, which corresponds to the smaller spacing, by the correction factor ρ_s/ρ_a, and by the appropriate Wenner conversion factor (in the example given, this would be 1000).

(5) The resultant is the resistivity of the surface layer.

Although the above was derived on the assumptions of uniformity given, it is felt that for any conditions where the resistivity increases with depth, the value thus obtained is a better approximation of the resistivity at a depth of about 3 ft than can be obtained by any method of comparable simplicity. ■

INTRODUCING A NEW

GLYCOL PUMP



for GAS DEHYDRATORS

FEATURING a new principle of operation—The power source is WET GLYCOL from the absorber plus a small amount of gas.

ELIMINATES ABSORBER LEVEL CONTROLS

PV Series – Capacities from 40 G.P.H.

MANUFACTURED BY

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pipeline news • *Cont'd.*

from page 177

side FPC jurisdiction; (4) they would violate constitutional prohibitions, including unreasonable search and seizure and taking of property without due process of law; (5) FPC has already recognized its inability to issue such orders; (6) FPC has recognized the burdensome nature of the proposed rule by exemptions contained in it; (7) such an order should not be issued while Congress is considering the Harris bill or while cases are pending in federal courts which could result in exempting independent producers from FPC regulation.

100 MMcf/day increase planned by Texas Eastern

A system increase of 100 MMcf/day is planned by Texas Eastern Transmission Corp., Shreveport (Docket G-12446 et al).

In its application to the FPC, Texas Eastern said the $50 million project will consist of 267 miles of pipeline and 2200 hp in compressor capacity. Thirteen existing customers will benefit from the increase in capacity.

Texas Eastern's affiliate, Texas Eastern Penn-Jersey Transmission Corp., also proposes a construction program of 65.5 miles of loop and 4000 hp in compressor capacity to increase its system capacity by about 60MMcf/day. These facilities will be leased to Texas Eastern.

Included in Texas Eastern's plans are 22 miles of 14-in. supply line in Louisiana, 105 miles of 30-in. pipe paralleling sections of its existing system between Opelousas (La.) and Kosciusko (Miss.), and 140 miles of 30-incher paralleling its system between Kosciusko and Uniontown, Pa. The 2200-hp would be installed at a new station in Louisiana.

Gas from Mexico moving northward

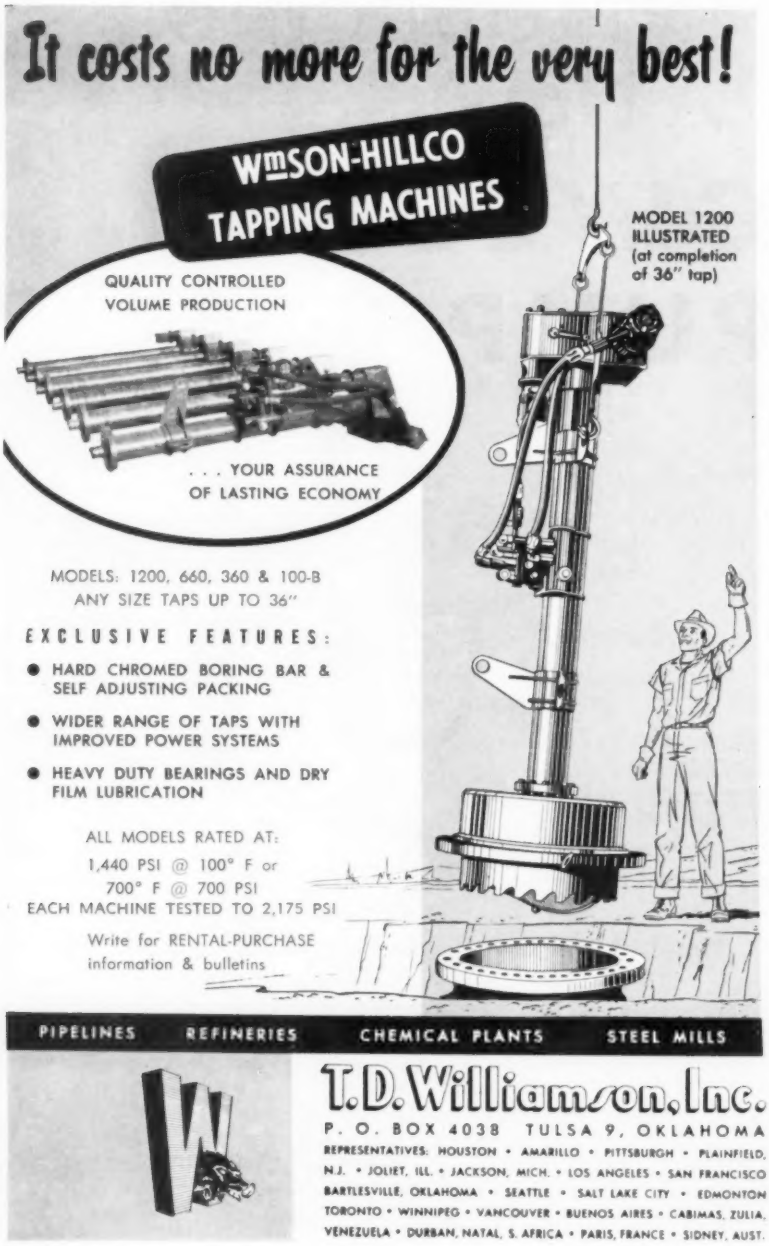
Gas from Mexico is now flowing through the 5900-mile system of Texas Eastern Transmission Corp.

Initially, Texas Eastern will take 126 MMcf/day from Mexico with provisions for this amount to be increased to 200 MMcf/day as new reserves are developed. The gas being imported comes from Brasil, Trevino, and Lomitas fields located in northeastern Mexico. Processed at the Petroleos Mexicanos (Pemex) natural gas processing plant at Reynosa, the gas crosses the border near that city.

Demand-commodity rate okayed for Am-La

An FPC examiner has filed a decision allowing American Louisiana Pipe Line Co., Detroit, to file revised natural gas tariffs. The new tariff will provide for a demand-commodity form of rate instead of the cost of service type previously prescribed by the commission.

The examiner said the present inquiry is limited to the question of whether the data acquired by the company in its operations are adequate to establish a cost of service which may be expected to obtain for a reasonable future period. He said the commission orders didn't indicate an inclination to hold the company to the cost-of-service form for any period longer than necessary to acquire the data, this, of course, providing a reliable basis for a cost of service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• WIDER RANGE OF TAPS WITH IMPROVED POWER SYSTEMS
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700° F @ 700 PSI
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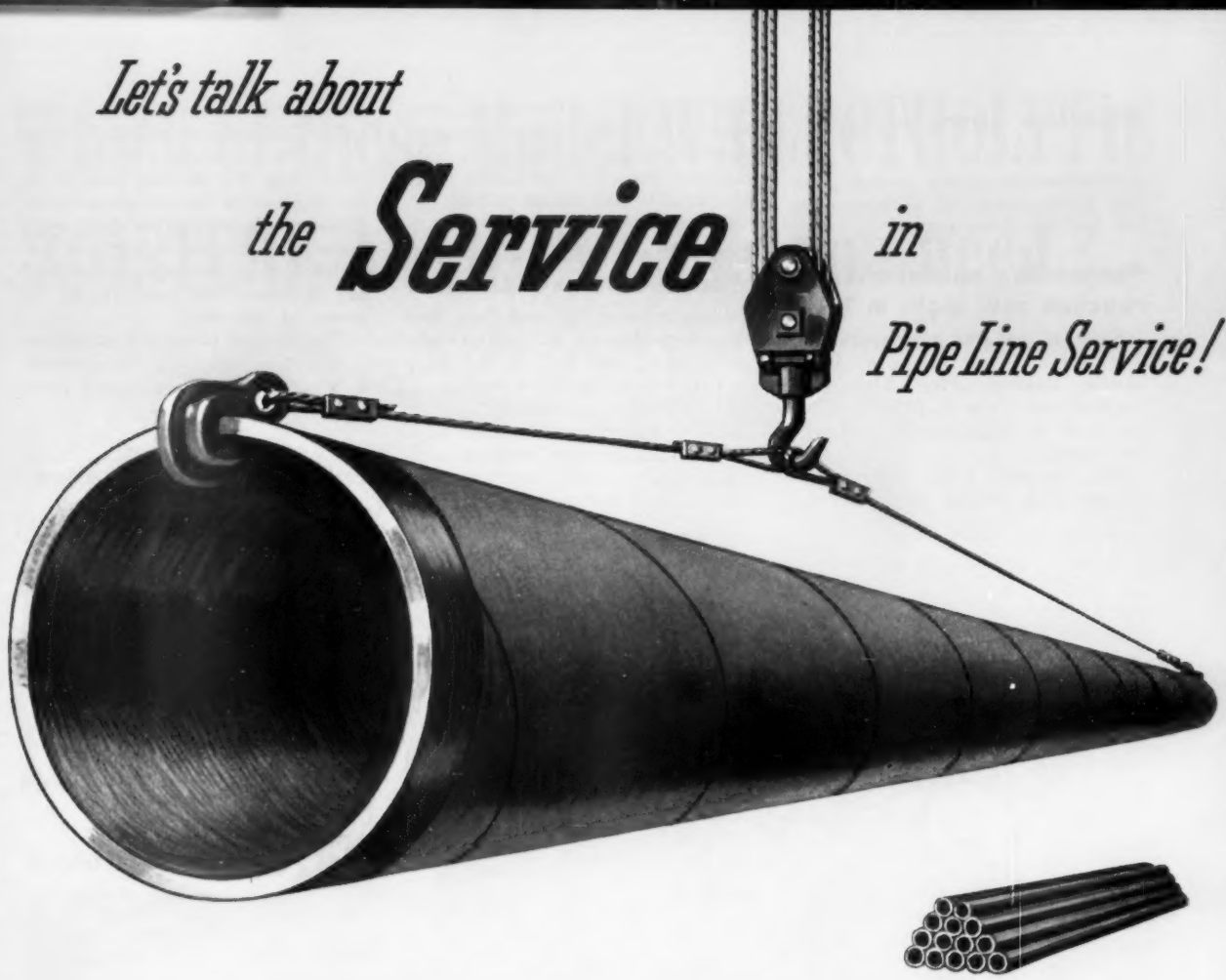
Let's talk about the **Service** *in Pipe Line Service!*



A company doesn't become a leader through quality of product alone. Although Pipe Line Service through the years has proved consistently that quality depends on coating and wrapping under controlled plant conditions, *service* is half the battle.

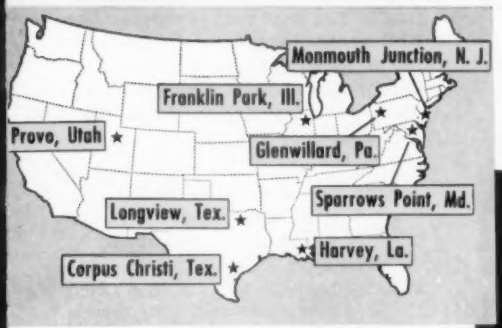
By service, we mean storing your pipe *at no cost to you* . . . plants strategically located near your sources of supply . . . and large storage facilities to allow you to purchase pipe when delivery is most favorable. Your pipe will be held in storage until needed—and then coated under the PLS high standards of uniformity.

You *always* get a freshly applied coating job at the time pipe is ready to be laid. And PLS will ship your protected pipe *where* you want it . . . *when* you want it!

All this, *plus* the service of a PLS representative when needed. It's his job to help you in the proper handling, storage and laying of PLS protected pipe, to give you the maximum return on your investment.

This combination of quality *and* service assures you of the finest in pipe protection. On your next coating job call in your nearest PLS representative—you'll find that he can save you time, trouble and money.

There's a PLS plant strategically located to serve YOU!



Also sales offices at

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Pipe Line Service Corporation

FRANKLIN PARK, ILLINOIS

Quality pioneers in coating and wrapping pipe for a quarter century

determination which would govern development of a fixed rate for the indefinite future.

Panhandle's operations reached new highs in 1956

Sales of natural gas, operating revenues and net income of Panhandle Eastern Pipe Line Co. reached new highs in 1956, according to W. G. Maguire, chairman of the board.

Net income, after taxes, increased $1.6 million over 1955 to total $19 million. Operating revenues were $112.6 million compared to $98.7 million in 1955, and total gas sales exceeded 400 billion cu ft compared to 352 billion in 1952.

Electricweld line pipe produced at new J&L mill

Jones & Laughlin Steel Corp. has started production of electric-weld line pipe—a new product for J&L—at its new $8 million pipe mill at the Aliquippa (Pa.) works.

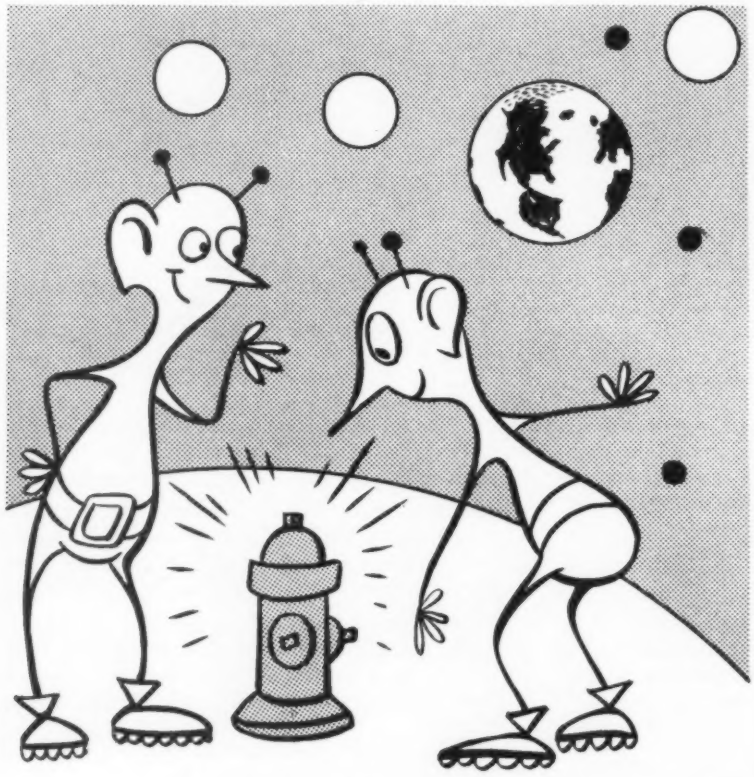
All operations at the new mill are controlled from strategically located push-button stations. The speed of each unit is adjusted automatically to synchronize with other units. Innovations include feeding the 2300-volt electric current directly into the welding transformer, eliminating intermediate transformers. According to J&L engineers, this decreases current impedance, thus increasing the speed of response and availability of power at the weld.

The forging press is electronically measured, allowing the operator to maintain a predetermined pressure.

Expansion, diversification boost TET revenues

According to the quarterly statement from Texas Eastern Transmission Corp., consolidated net income for the second quarter of 1957 rose substantially over the same period last year.

Net income for the three months ended June 30 amounted to $4,579,248. This compares with the net of $3 million in the second quarter of 1956.



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Anywhere . . . anytime!
Parkhill has the men, the equipment
and the experience to handle your next pipe
stringing job, large or small. Give us a call
and park your problems with Parkhill.

PARKHILL TRUCK COMPANY
TULSA, OKLAHOMA

GAS pipeline notes

Texas Co. is building a multimillion dollar natural gas processing plant in San Juan county, Utah. Size and cost of the plant will depend on how many other oil and gas companies may want to share in the ownership of the plant, which will process gas from the Aneth field.

Jerome Kuykendall has taken the oath of office for a new term on the Federal Power Commission. He first joined the commission in May, 1953.

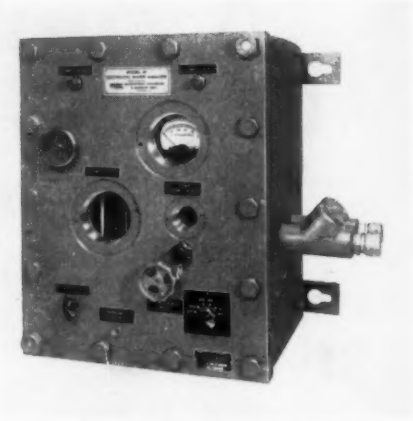
Ohio Fuel Gas Co., Columbus, plans to build about 33 miles of 4- to 20-in. line to meet rising demands and improve operations. The $1.2 million construction job will be in Lorain, Belmont, Guernsey, Champaign, Logan, Greene, Clark, Madison, Fayette, Licking, and Richland counties.

Oral argument is slated for Oct. 3 on United Fuel Gas Co.'s proposal to sell summer storage gas at a special rate to two affiliates. This gas could not be utilized by United Fuel's other customers now served under the regular contract demand

Which of these Model W ELECTROLYTIC MOISTURE ANALYZERS do you need?

STANDARD UNIT

Shown with Model A Oil Separator and Model I Vaporizing Valve mounted on side panel.



EXPLOSION-PROOF UNIT

Available with or without thermostatic controls.

Many other types also available for measuring moisture content down to better than 1 part per 1,000,000!

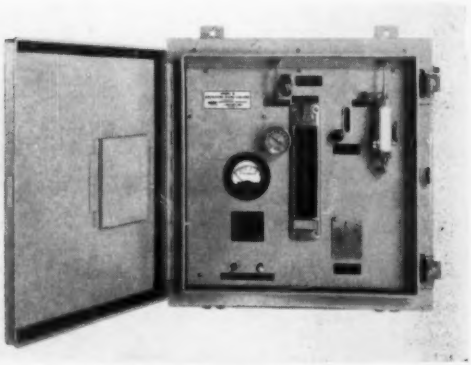
Rapid adoption of the *Meeco* Model W Electrolytic Moisture Analyzer has made possible the introduction of many different types — to fit most any requirement you have.

New types (in addition to those shown) include relay rack units . . . units for flush panel mounting . . . and units for measuring moisture in liquids — in either standard or stainless steel construction.

Instruments for automatic control of moisture content of gases are also available.

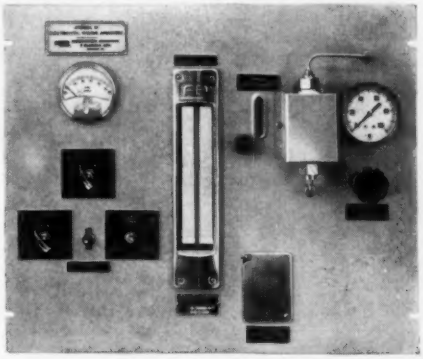
Any of these units can be obtained with calibration in parts per million by volume or pounds per million standard cubic feet. All are available in extended ranges, and measure moisture content of a versatile range of gases on an absolute basis. Conversion curves to dew point indication can be obtained on request.

Write us today for complete information on the model that is best suited for your own particular purpose.



WEATHER-PROOF UNIT

For fixed or portable installation — available with or without thermostatic controls and insulation. Battery operation optional.



TYPICAL RELAY RACK PANEL UNIT

Shown with Model I Vaporizing Valve.

MANUFACTURERS ENGINEERING & EQUIPMENT CORP.

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MEECO Instruments

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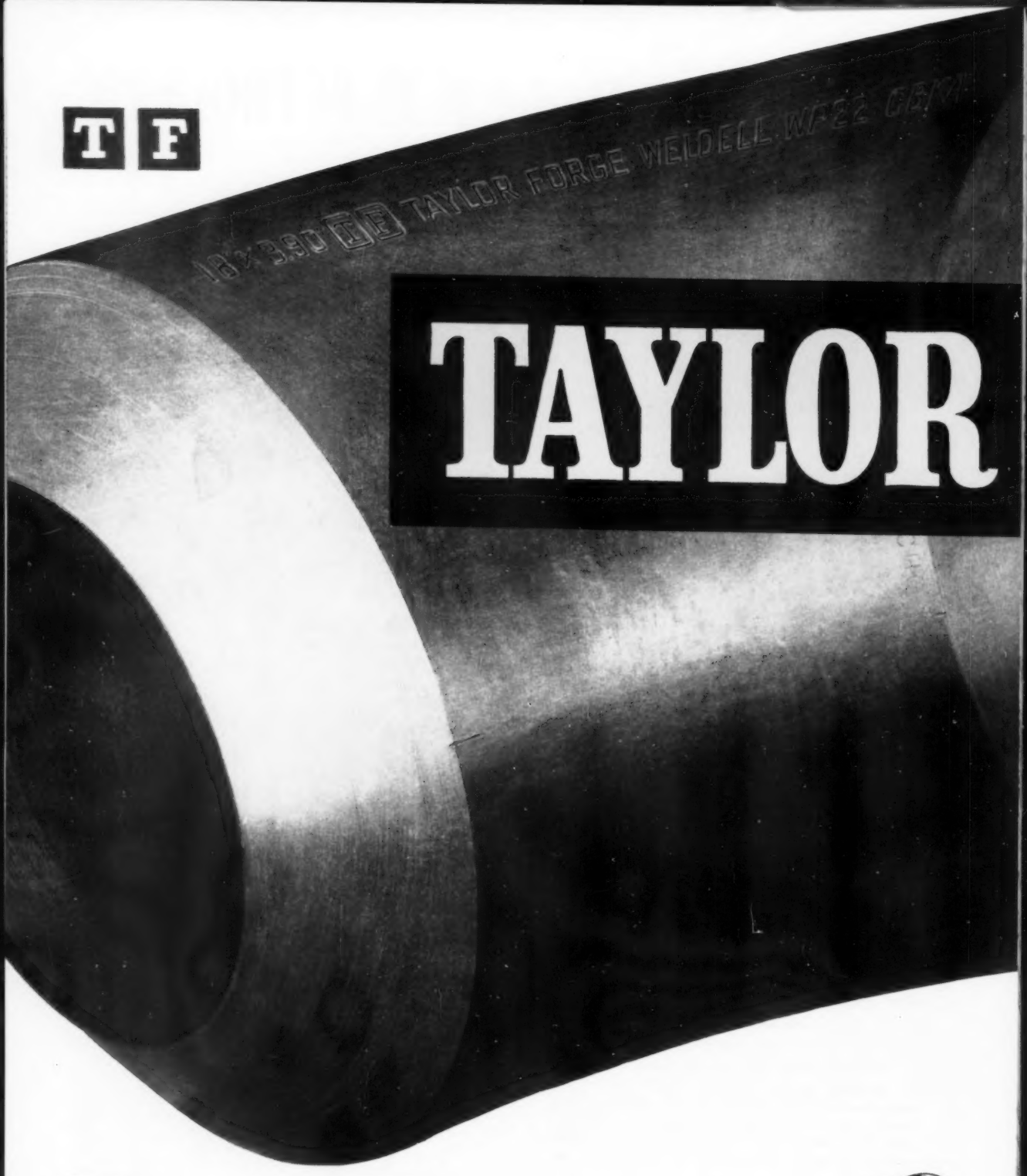
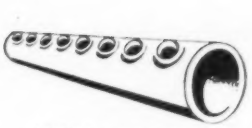
TAYLOR



Welding nozzles

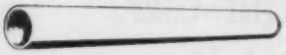
T.E.M.A. flanges and channels


Multiple outlet headers

Production forgings

Venturi reducers

Spiral weld pipe


Large diameter electric weld pipe

Welding necks

For utmost value

FORGE Welding Fittings and Forged Flanges

Whether it's a "heavyweight", like the big special wall thickness WeldELL pictured here, or a Schedule 5S Stainless Steel "lightweight"—in fact *any* thickness, size or type of Welding Fitting or Forged Flange—you can be sure of utmost value if it's made by Taylor Forge.

In 57 years of specialized forging experience we've learned how to make metals do precisely what we want them to do . . . how to form them to exact dimensions . . . how to control grain flow so as to put extra strength where it is needed . . . how to maintain great accuracy and finest quality in everything we make from the smallest to the largest unit.

All of this is just another way of emphasizing the fact that Taylor Forge Welding Fittings and Forged Flanges can be depended upon to meet your most exacting requirements . . . to provide utmost value.

So . . . remember . . . for everything in Welding Fittings and Forged Flanges . . . every size, type, thickness or pressure rating . . . every forgeable material . . . it pays to turn to Taylor Forge . . .

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MILLION
MILES
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You know about Heath Leakage Control Surveys, but . . .

. . . did you know that Heath is the leader in pioneering new methods and new equipment to make leakage control surveys *more valuable* to gas utilities . . . and the communities which they serve?

Mobile infra-red gas analyzer units are available. We often collect and present data for claims cases, make surveys during new construction and conversions.

Whenever your problem has to do with gas that *might* become a problem, you will do well to call —

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pipeline news • *Cont'd.*

rate. Earlier, an FPC presiding examiner ruled against the proposal.

Application for rehearing, a request for stay, and a motion to reopen the record on the Little Inch conversion have been denied by the FPC.

Ledeen Manufacturing Co., El Monte, Calif., has named Ontor Ltd., Toronto, Canada, distributor for the company's line of cylinders, valves, valve operators and air hydraulic pumps and boosters. Ontor will represent Ledeen in all Canadian provinces with the exception of British Columbia and Alberta.

* * * *

The FPC recently issued certificates to:

Natural Gas & Storage Co., Chicago, for operation of storage facilities in the Cooks Mills area of Coles and Douglas counties, Ill. The new facilities will enable NGS to inject gas at an estimated rate of 25 MMcf/day.

Ohio Fuel Gas Co., Columbus, for construction and operation of facilities which will help meet increased requirements in eastern Toledo, Gibsonburg, Genoa, and Woodville. Included in the $3.5 million plan: About 53 miles of line ranging from 4.5- to 24-in. diameter.

Northern Natural Gas Co., Omaha, for $1.6 million worth of facilities in Hansford county, Texas, consisting of 12.7 miles of 16-in. line to replace an existing 10-incher to boost the capacity of its Spearman dehydration facilities by 50 MMcf/day. As a result of new contracts, Northern Natural said it has about 445 billion cu ft of reserves under contract in the area with a daily delivery estimated at 56.4 MMcf.

Michigan Wisconsin Pipe Line Co., Detroit, for 22 miles of 24-in. loop in Illinois and Wisconsin. The $1.8 million construction of two 11-mile segments will completely loop the company's mainline serving Wisconsin and provide an increased safety factor.

Permian Basin Pipeline Co., Omaha, to acquire and operate two 1350-hp units built by Phillips Petroleum Co. in Permian's Andrews county (Texas) compressor station. Cost: $842,800.

Cities Service Gas Co., Oklahoma City, to develop the Elk City storage field in Montgomery county, Kan. The field is expected to supply 50 MMcf on the peak day in 1958-59 and 100 MMcf in 1959-60. Cost is estimated at $2.6 million.

New York State Natural Gas Corp., Pittsburgh, for $1.2 million worth of facilities in New York which will be used to make gas deliveries to Niagara Mohawk Power Corp. at Syracuse.

Home Gas Co., Pittsburgh, to build and operate about $3.8 million worth of facilities in New York. Home Gas plans a storage field expansion in Schuyler, Steuben, and Yates counties.

The ol' swimming hole holds far more appeal for these young Canadians than does the construction of the Trans-Canada Pipeline. The pipeliners were crossing the LaSalle river, south of Winnipeg.

GAS DISTRIBUTION LINES

Youngstown line pipe plays important role in nation's vital gas distribution systems

America's vast network of gas distribution lines work silently around-the-clock to provide a dependable supply for both industrial and commercial users. Leading systems specify Youngstown's quality-controlled steel Line Pipe because it offers: Easy bending, uniform wall thickness, excellent line-up characteristics, outstanding weldability and longer lengths—all of which save them time and trouble when laying lines.

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Producers of Carbon, Alloy and Yoloy Steels
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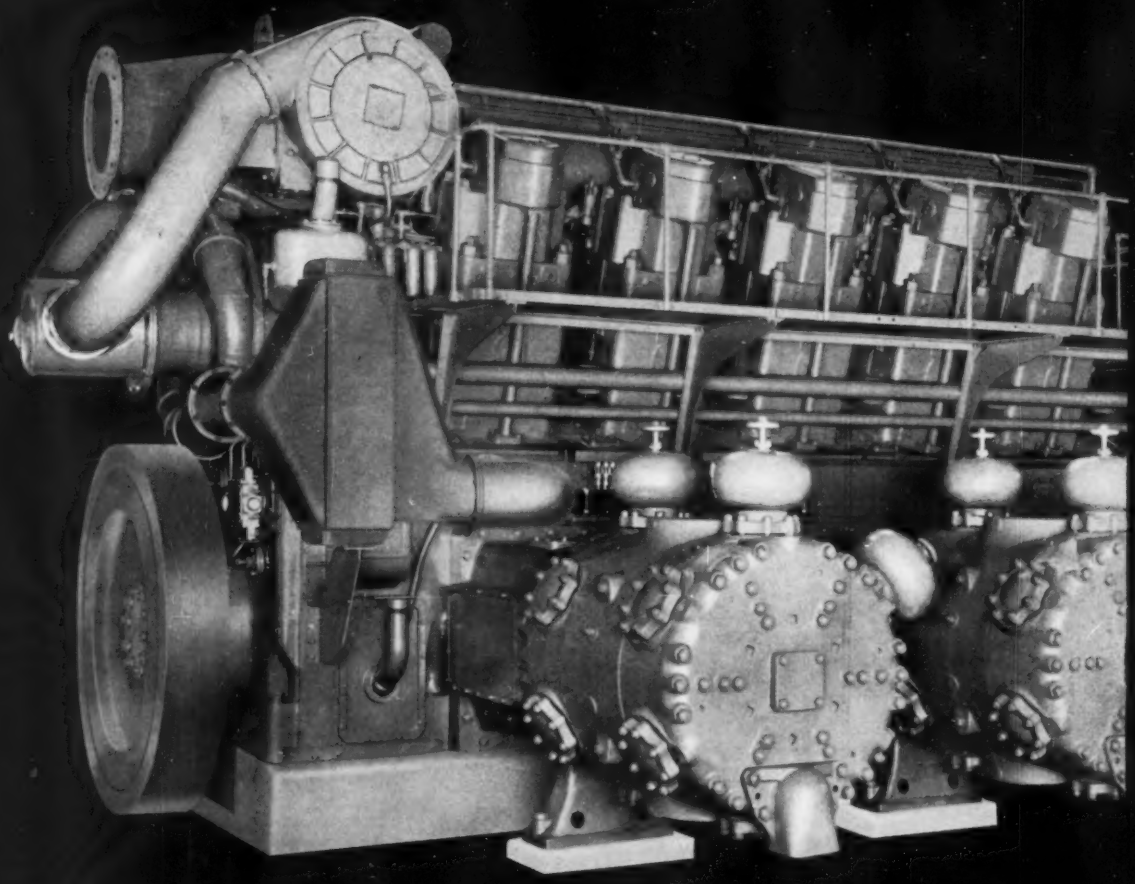
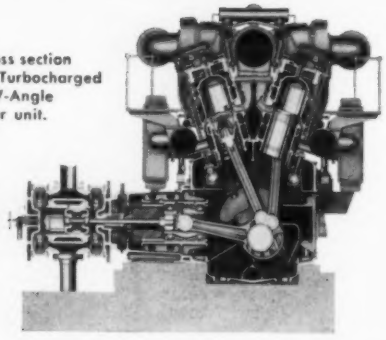
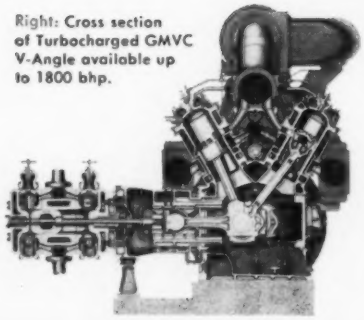
Full range efficiency...



Right: Cross section of Series Turbocharged GMWC V-Angle compressor unit.



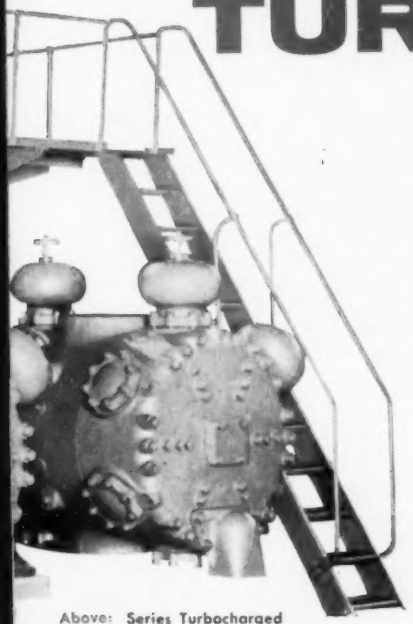
Right: Cross section of Turbocharged GMVC V-Angle available up to 1800 bhp.



with Cooper-Bessemer

SERIES TURBOCHARGED

V-Angle Compressors



Above: Series Turbocharged GMWC V-Angle rated 3500 bhp at 250 rpm. The largest and most efficient available today.

Remarkable gains in power output, fuel economy and power-to-space ratio, as important as they are, fail to reveal a key feature of Series Turbocharging. What about performance at start-up and at reduced speeds and loads? Here is one of the underlying factors in Cooper-Bessemer's development of this unique turbocharging system.

With both exhaust-driven and engine-driven turbo compressors operating in series, efficient supercharging is by no means limited to optimum full-load conditions. In fact, *at no time* is supercharging effect completely dependent on exhaust pressure or exhaust heat.

For further details on these and other unusual advantages featured by Series Turbocharged V-Angle Compressors, ask for Bulletin ST-82 . . . or contact the nearest Cooper-Bessemer office.

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COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINE OR MOTOR DRIVEN

GAS pipeline people

JAMES C. MAHAFFY has been appointed general manager of the Alberta Gas Trunk Line Co. Ltd., Calgary. Mr. Mahaffy, who has been secretary-treasurer, succeeds W. F. KNODE, who resigned.

W. E. BROWN, superintendent of compressor design engineering for Texas Gas Transmission Corp., Owensboro, Ky., has retired after devoting 50 years to the engineering field. Mr. Brown, an employee of Texas Gas since October 1949, laid out and supervised the design for compressor station additions made along the Texas Gas system since that date.

ROBERT M. HOFFER has been named controller of Michigan Wisconsin Pipe Line Co. and American Louisiana Pipe Line Co., Detroit. He will also serve as controller of the American Natural Gas Service Co.

The Montebello fabricating division of Kaiser Steel Corp. has appointed JERRY P. ANDERSON to the sales engineering staff and named FRANK E. COOPER as purchasing agent.

Howard Boyd
El Paso

Robert M. Hoffer
Mich-Wis.

N. T. Shideler
Pittsburgh Coke

Arthur E. Gray
Pittsburgh Coke

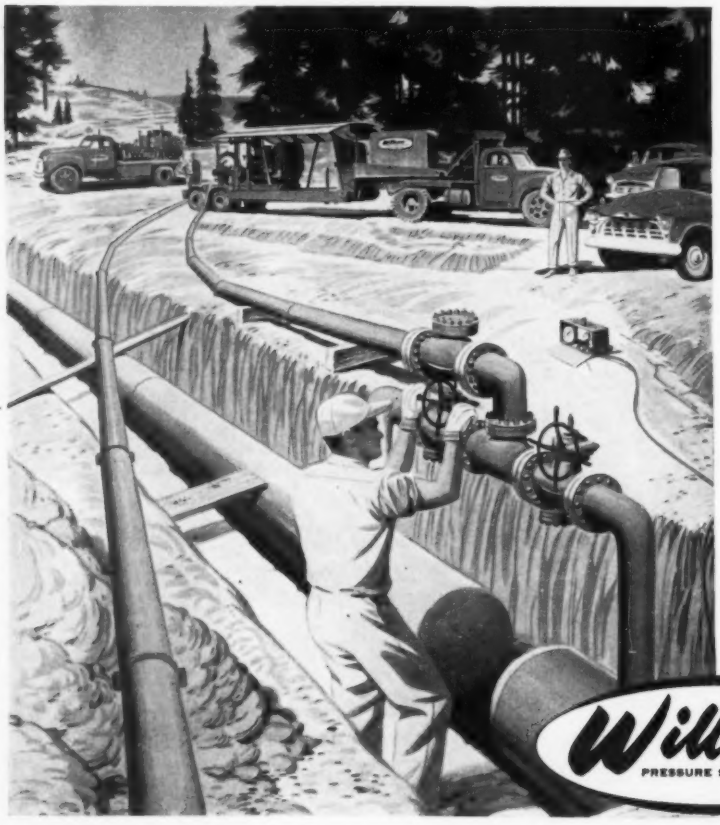
A. D. KRONEY and ROY E. PITTS have been appointed assistant general counsels of Lone Star Gas Co. and Lone Star Producing Co. Mr. Pitts, a veteran of 24 years' service with Lone Star, has been an attorney for the company since 1937. Mr. Kroney joined the Dallas-based company in 1934.

JAMES H. MCBRIEN has been named general sales manager for F. H. Maloney Co., Houston.

JOSEPH WALLA, JR. has joined Northern Natural Gas Producing Co. as district geologist at Calgary, Alberta.

S. MERLE HARDISON is district manager in Philadelphia for Tube Turns, Louisville, Ky. He succeeds W. E. GEISER, who has returned to the headquarters staff in Louisville.

HOWARD BOYD has been elected to the newly created post of executive vice president of El Paso (Texas) Natural Gas Co. Mr. Boyd has been a vice president and assistant general counsel of El Paso since he joined the company in 1952. He has been a member of the board since early 1953. Mr. Boyd is also vice chairman of the board of Pacific Northwest Pipeline Corp.



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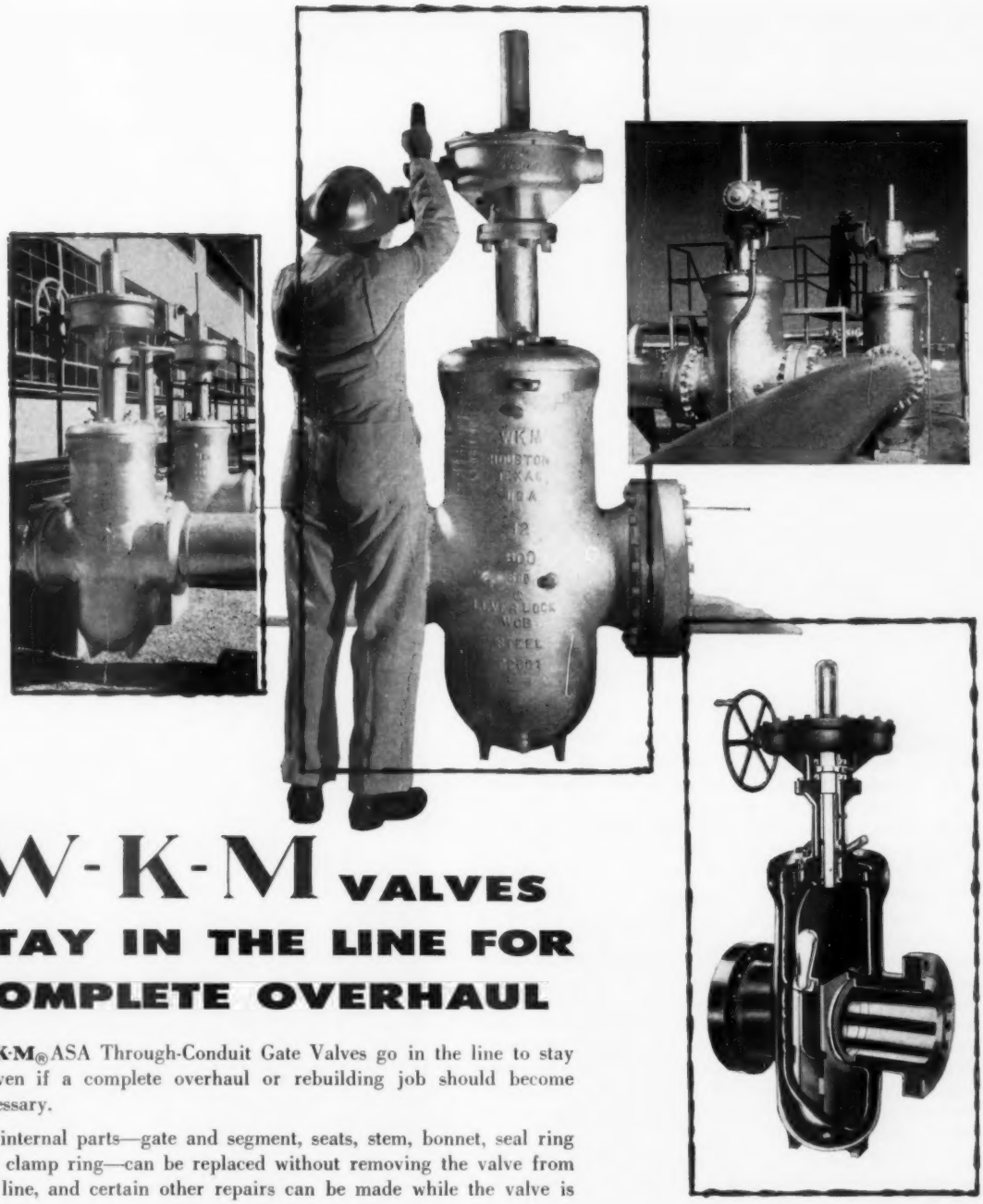

W-K-M VALVES

STAY IN THE LINE FOR COMPLETE OVERHAUL

W-K-M® ASA Through-Conduit Gate Valves go in the line to stay —even if a complete overhaul or rebuilding job should become necessary.

All internal parts—gate and segment, seats, stem, bonnet, seal ring and clamp ring—can be replaced without removing the valve from the line, and certain other repairs can be made while the valve is *under pressure.*

Precise engineering and manufacture of **W-K-M** valves reduce maintenance to a minimum. But when repair needs do arise, costs stay low—because **W-K-M** valves stay "in the line."

***W-K-M** ASA Through-Conduit Valves are available in sizes 2" through 30"—ASA 300 lbs. to ASA 900 lbs. Valves up to 12" are available through supply stores.*

W-K-M is a registered trademark of ACF Industries, Incorporated.

Bring your valve reference library up-to-date by writing Dept. K-10 for new W-K-M ASA Through-Conduit Gate Valve Catalog 300.

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VERSATILITY

got GARRETT RELIEF VALVES

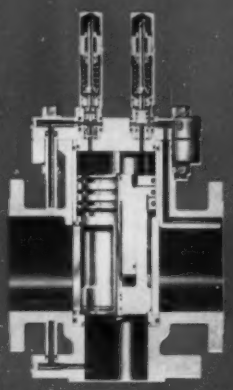
Look the field over and you'll not find another valve that offers as much as the Garrett Relief Valve.

First, there's unequalled accuracy and dependability, obtained by placing opening and closing functions in two controls that are entirely independent of each other. The differential-area design allows a pressure-opened, pressure-closed main plunger that is free of the inconsistencies present when a large, stiff spring is used.

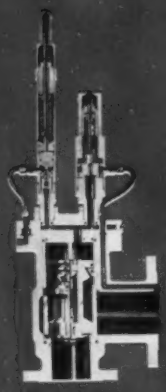
Secondly, the Garrett Valve may be used as a blowdown valve without affecting its function as a relief valve. Through the addition of a simple Garrett "operator," a solenoid valve or other suitable control, it can be opened manually from a remote location, or tied into an automatic safety shut-down system. This versatile valve can be applied to almost any piping layout. And of great importance to present users, existing Garrett Valves may be equipped for remote control or safety shut-down without even taking them out of the line!

For a complete explanation of these and other reasons why Garrett Valves have become "standard" on so many transmission and distribution systems, contact your nearest Garrett representative or write for Bulletin No. RV-103.

REPRESENTATIVES THROUGHOUT THE UNITED STATES AND ABROAD



Garrett Type "D" Relief Valve. Sizes, 1" through 8", single or dual outlets, for working pressures from 150 to 5000 psi. Supplied with soft or hard seats, screwed or flanged connections.



Garrett Type "E" Relief Valve. Sizes, 1" through 3", for working pressures from 25 to 200 psi. Soft or hard seats, screwed or flanged connections.

Garrett Oil Tools, Inc.
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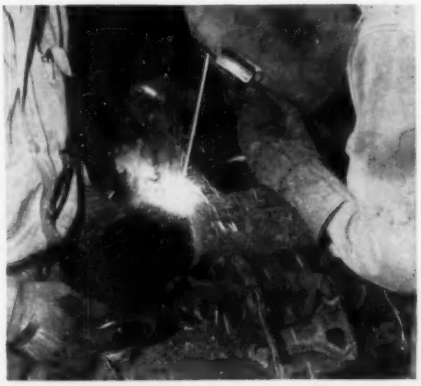
ON THE JOB with Manufacturers Light and Heat Company...

tt TUBE-TURN

LIGHTWEIGHT PIPING . . . HEAVYWEIGHT SAVINGS. A pioneeer in the use of lightweight pipe and fittings for gas distribution systems, Manufacturers Light and Heat Co. is using these lower cost materials for its current construction program for area measurement work. TUBE-TURN* Lightweight Fittings, such as the 90° elbow shown, play an important part in this work, helping to speed construction and cut costs.

TUBE-TURN® Fittings speed up area measurement program

HOT TAPPING THE SAFE WAY. Manufacturers are an extensive user of TUBE-TURN Full Encirclement Saddles for making strong, safe hot tap connections. This installation in an 8" line near Wellsville, Ohio, will connect to new measuring facilities.



TIME SAVER. Subassemblies for measurement stations are prefabricated in the shop to speed up field work. The true circularity and uniform wall thickness of TUBE-TURN Fittings help assure good fit-up and fast welding.

TUBE-TURN Fittings are available from your nearby Tube Turns' Distributor.

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REMOTE SUPERVISORY SYSTEM
Can give greater pipeline throughput at a lower cost

IT CONTROLS:

Starting and stopping of remote compressor, and reports compliance.

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IT TELEMETERS:

Compressor discharge pressure.
Compressor suction pressure.
Gas temperature.
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IT MONITORS:

Remotely transmitted alarms or non-compliance signals and identifies source.

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(Twenty to thirty alarms per station are practical).

HUPP MASTER SUPERVISORY CONTROL STATION

The greater supervisory capacity, flexibility, and speed of this system make possible new pipeline operating efficiency. A system capacity of over 1000 different codes . . . **no supervisory system limitation** to the number of signals transmitted for the usual pipeline. Simple pulse codes assure unmistakable accuracy. All signals can be handled on the lowest cost telegraph line, or telephone or microwave channel. Modular construction and proved dependability give you minimum maintenance.

WRITE us today giving us your system requirements. Literature and recommendations will be sent you.

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761 Circle Avenue • Forest Park, Illinois

Washington • *Cont'd.*

(*From page* 17)

higher than for some other industries is the long periods of uncertain earnings, or losses, while a state regulatory agency ponders a rate increase request. In some states, a rate increase can be suspended for as long as nine months, and while laws usually require that the final rate take into account the revenue lost during a suspension, they rarely do, utility officials complain.

* * *

THE gas industry will be among the secondary targets of a new congressional investigation into whether regulatory agencies, such as the Federal Power Commission, are protecting the public interest or are dominated by the industries they are supposed to regulate.

The investigation, to be conducted by a House subcommittee on Legislative Oversight, has strong political overtones. It follows earlier investigations of the steel industry, profits on military jet engine contracts, and others with a general anti-business flavor.

The subcommittee is planning to open public hearings this fall. The Federal Communications Commission will probably be the first regulatory agency to come under congressional fire.

Rep. Morgan M. Moulder (D.-Mo.) is chairman of the subcommittee. The actual investigation will be directed by Bernard Schwartz, on leave as director of New York University's Institute of Comparative Law. The probe has the firm backing of House Speaker Sam Rayburn (D.-Texas) and has been given funds to run well into 1958, an election year.

The regulatory agencies are actually arms of Congress, rather than departments of the Executive Branch of government. The members are appointed by the president subject to Senate confirmation.

The charge has been made frequently in recent months that some regulatory agencies are exceeding their legal powers; are bowing to political or business pressures, and are more interested

Laclede Gas Company banks on I-R gas-engine compressors

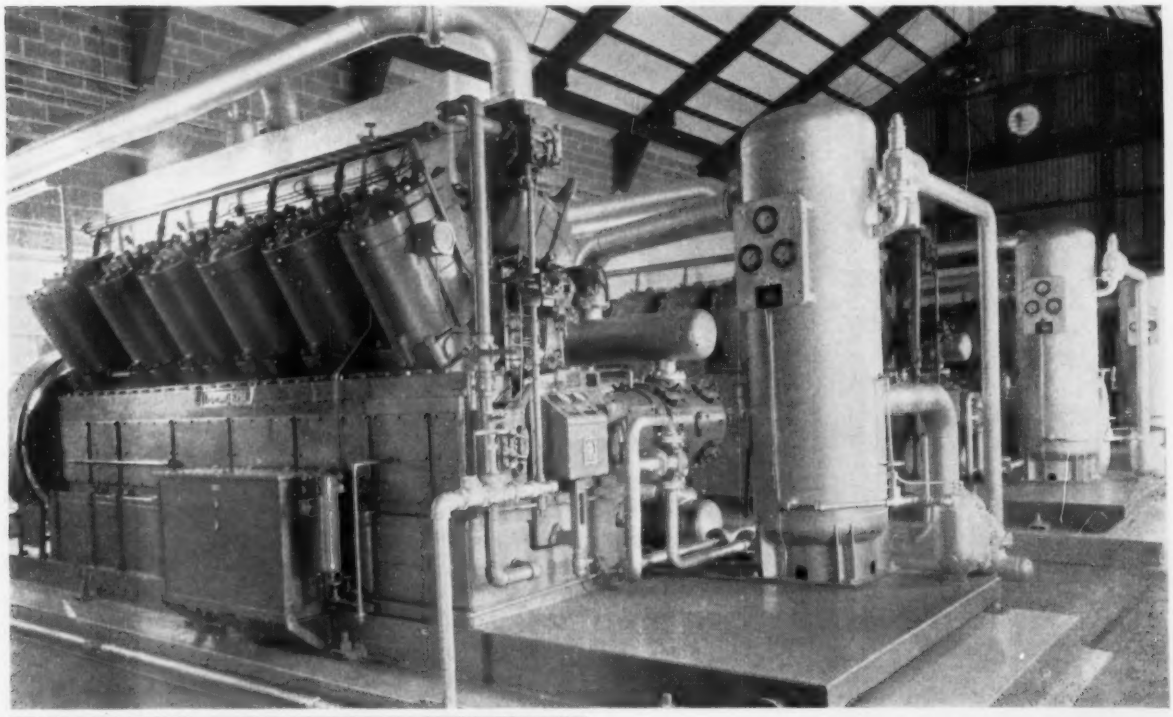
to store up to 16,000,000 cu ft of gas per day in underground "safe deposit vault"

In a natural sandstone vault 1600 feet underground, Laclede Gas Company of St. Louis has found an economical solution to its winter load problem. Receiving natural gas by pipeline from Louisiana, Laclede is injecting up to 16 million cu ft per day into a huge reservoir of porous sandstone which **never before held gas.**

Sealed by impervious layers of shale, the dome is believed to have a potential capacity of 50 billion cubic feet of pressurized gas. From this "safe deposit vault", the gas will be withdrawn to meet the heavy winter load, eventually making Laclede service available to more than 100,000 homes which could not have been served by the pipeline alone.

The entire gas-injection load is handled by three 660-hp Ingersoll-Rand SVG compressors, operating around the clock. These units are complete packaged compressor plants, supplied by the J. B. Beaird Company, Inc., and include scrubbers, manifolds, coolers, exhaust silencers and engine-driven oil and water pumps. Starting air is supplied by I-R auxiliary compressors.

Excellent 4-cycle stability at all loads and speeds make the SVG compressor ideal for gas-injection service, which involves frequent load variations and continuous heavy-duty operation. For more information on 4-cycle V-angle gas-engine compressors from 120 to 2000 hp, call your Ingersoll-Rand representative today.



***Only I-R compressors have CHANNEL VALVES**

Known for high efficiency, quiet operation and exceptional durability. Entirely different. Each valve is a combination of rigid stainless-steel channels and leaf springs, with trapped-air spaces which cushion action.

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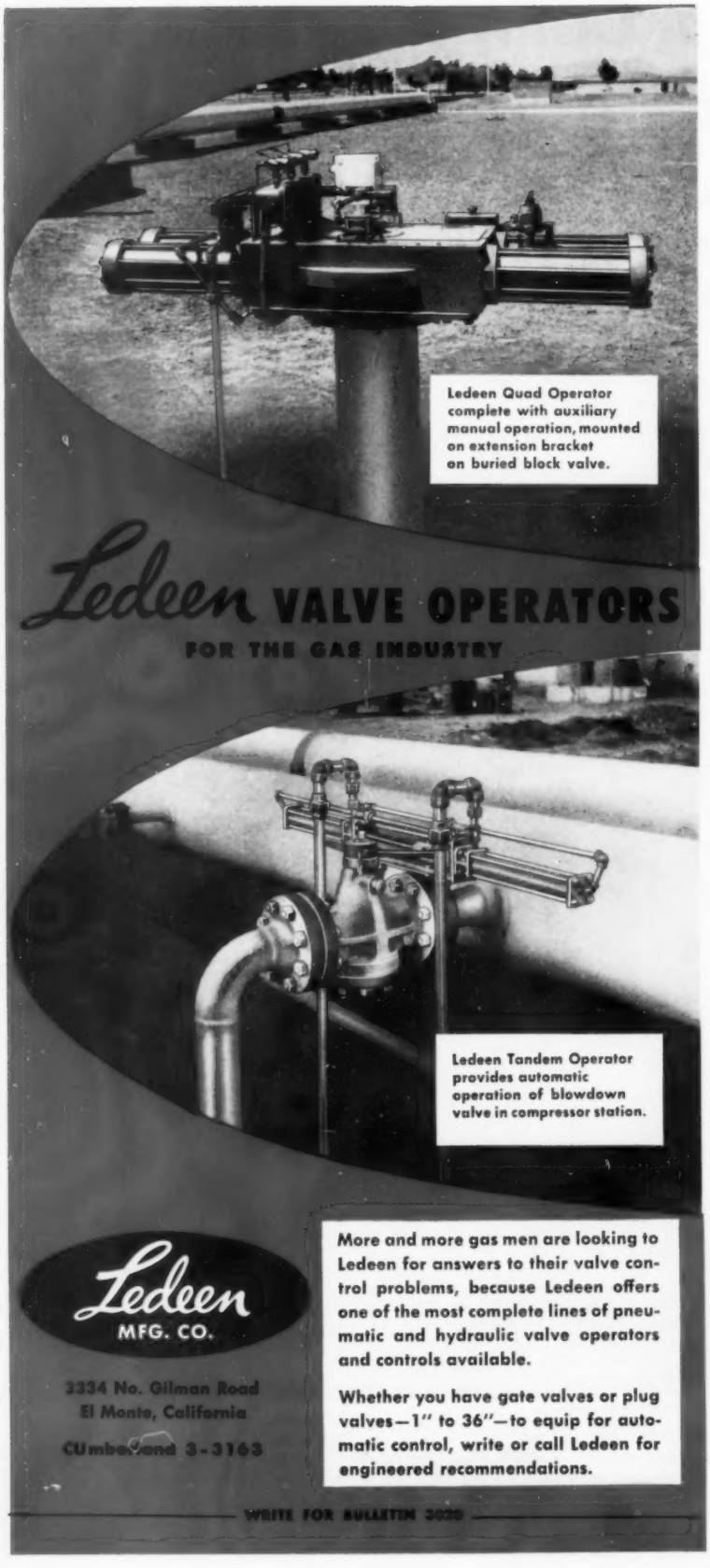
Ledeen Quad Operator complete with auxiliary manual operation, mounted on extension bracket on buried block valve.
Ledeen VALVE OPERATORS
FOR THE GAS INDUSTRY
Ledeen Tandem Operator provides automatic operation of blowdown valve in compressor station.
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More and more gas men are looking to Ledeen for answers to their valve control problems, because Ledeen offers one of the most complete lines of pneumatic and hydraulic valve operators and controls available.
Whether you have gate valves or plug valves—1" to 36"—to equip for automatic control, write or call Ledeen for engineered recommendations.
WRITE FOR BULLETIN 3020

in serving the industries they are supposed to regulate than in protecting the public.

A renewal of the charges thrown at FPC Chairman Jerome Kuykendall during his fight for Senate confirmation to a new term will be brought up against him and other members of the regulatory agencies.

During the hearings, the charge will undoubtedly be made that industries such as gas producing firms attempt with some success to dominate the commissions empowered to regulate their operations.

* * *

RISING steel prices on top of continued tight supply will continue to harass the gas industry, top steel experts predict.

The steel industry's recent price increase averaging $6 a ton, and continually rising freight rates over most of the country, will mean that gas producers, pipelines, and distributors generally will be paying out more for their capital construction materials.

A recent Interstate Commerce Commission decision to permit the railroads to cut freight rates on iron and steel pipe shipments from points east of the Rockies to the Southwest will help hold costs down some, but not much.

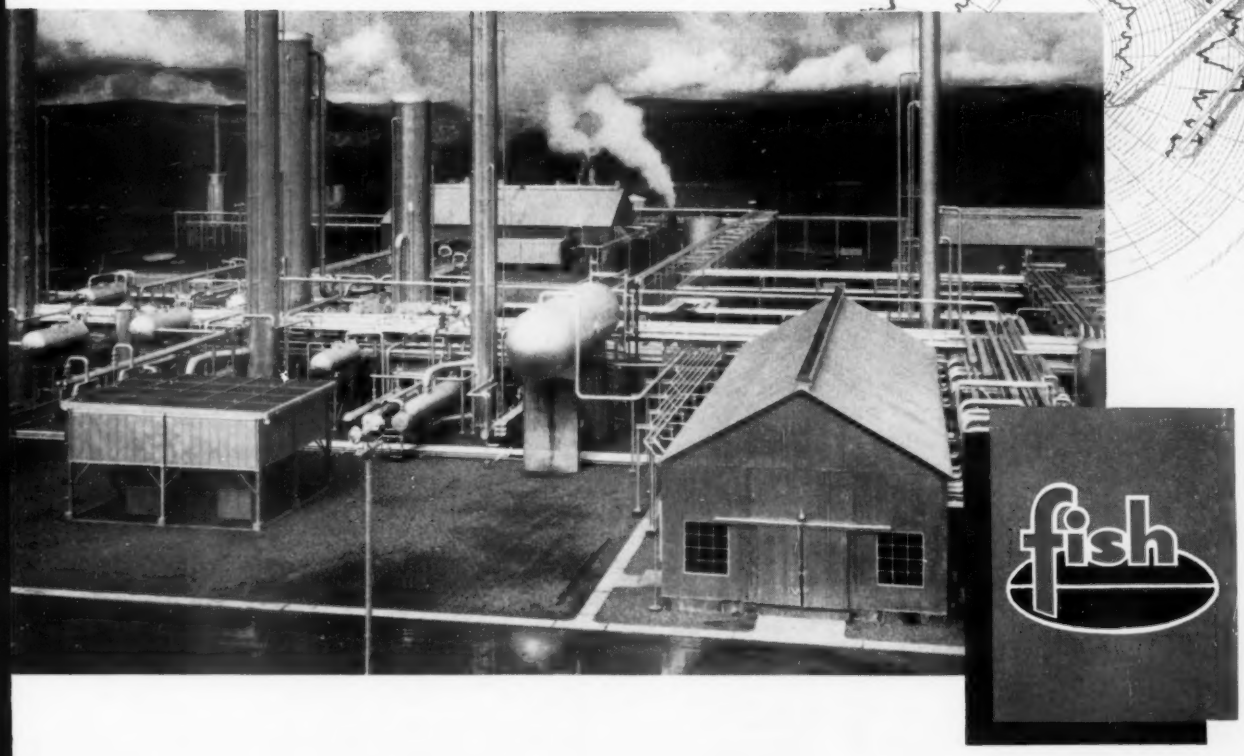
The oil and gas industry in 1956 received 5.5 million net tons of steel, but still greater tonnages will be needed in the future, the steel industry predicts. Demand for super-strength steel as wells go deeper and deeper particularly will increase.

But the industry's capacity to produce pipes of all types and sizes is being increased slowly, so the supply picture won't improve materially for some time, the experts say.

The 5.5 million tons of steel the gas and oil industry purchased last year was 177 per cent more than similar shipments in 1946. The average depth of new gas and oil wells has increased from a little more than 2600 ft in 1934 to 4022 in 1956. By 1965, an average depth of 5200 ft is expected. To meet anticipated energy demands by 1965, many new wells will have to range in depth from 10,000 to 25,000 ft. ■

This gasoline plant operates efficiently despite

varying loads



The San Juan gasoline plant of the Pacific Northwest Pipeline Corporation is big! It was designed to handle 300 million cubic feet of gas per day and recover 340,000 gallons of liquids. But efficient operation over a wide range of loads was necessary.

Since it was placed on stream in October, 1956, the San Juan plant has operated efficiently and dependably at loads ranging from 20 per cent to nearly 100 per cent of capacity. This is an unusual record for a plant of this size.

Furthermore, because of a rigid timetable imposed by pipeline commitments, the plant was constructed in record time despite many unusual problems posed by terrain, weather and transportation.

Because of transportation limitations, the 90-inch by 56-foot absorbers had to be shipped to the site in sections. There, welding assembly was completed in the field. The units were then inspected and stress-relieved.

This is just one example of the way the Fish Companies tackle problems. Your problem may be entirely different.

If you are planning new facilities in oil, gas or chemicals, call on Fish for imaginative engineering . . . from feasability study to final completion.

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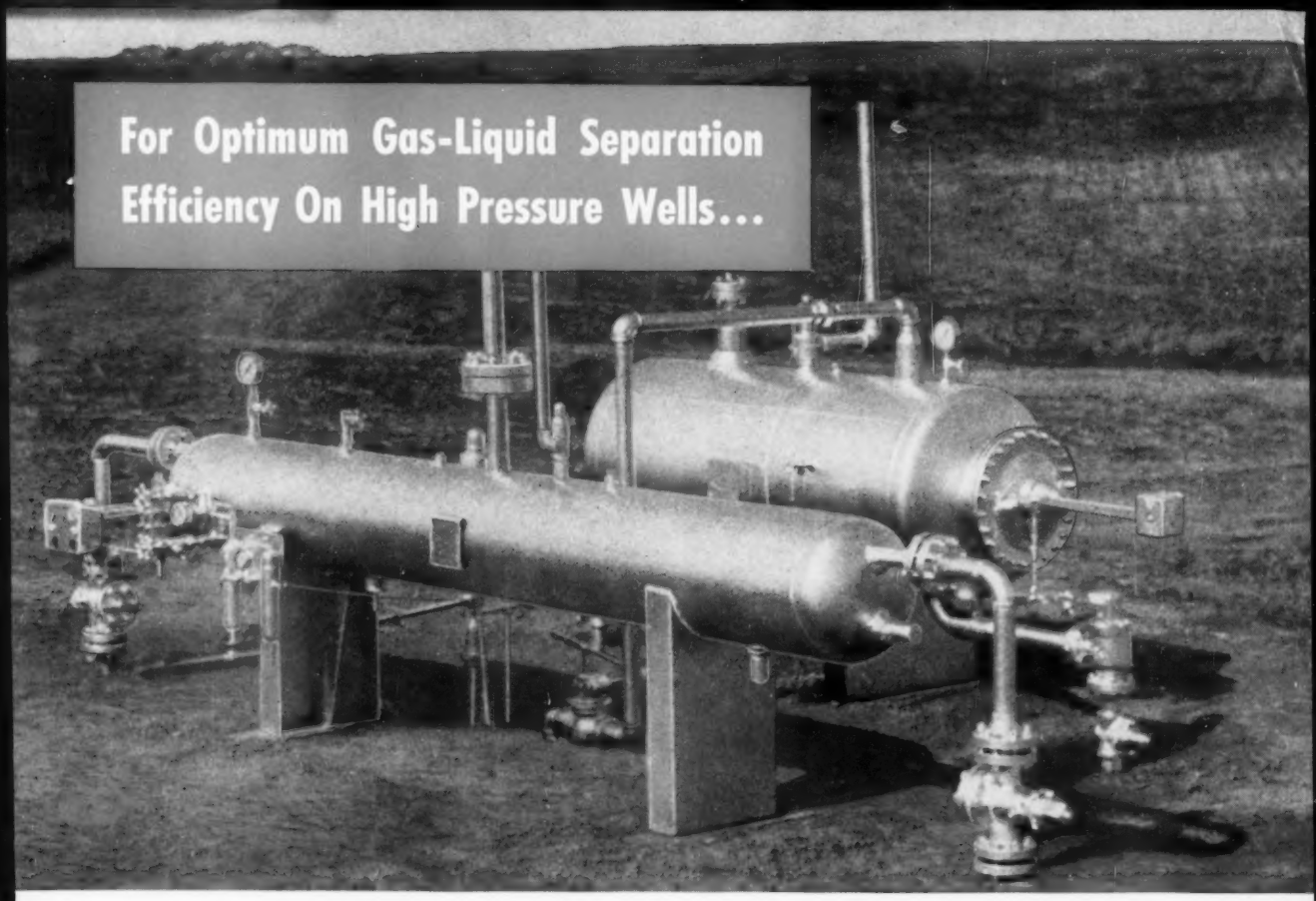

Specify

The BS&B Model DC Separator!

Because of its exclusive internal design incorporating a large gas-liquid separation chamber, a large liquid collecting and surge chamber, and a highly efficient mist extraction section all within its single horizontal cylinder, the Model DC Separator gives optimum separation efficiency on high pressure wellstreams.

Take the installation pictured above, for example. This Model DC Separator (foreground) is teamed up with a Model H Low Pressure Separator to form a two-stage hookup for processing the condensate-laden gas produced on a Kansas lease.

High gravity distillate is removed from the wellstream by the Model DC at approximately 60° F., and is then transferred to the Model H for further stabilization of the light ends at a reduced pressure of approximately 110 psi. Sales gas goes to the gathering line at 1000 psi, and condensate to the stock tanks at a pressure of 16 oz.

If you have a gas-liquid primary separation problem, why not get the facts on the Model DC from your BS&B Representative? Or you may write to . . .

MODEL DC SEPARATORS FEATURE...

- ✓ High Separation Efficiencies
- ✓ Proven BS&B Controls
- ✓ Easy Serviceability
- ✓ "In-Line" Hookup
- ✓ Excellent Cold Weather Operating Characteristics
- ✓ Wide Selection of Shell Sizes
- ✓ Working Pressures from 500 to 7500 psi.

EFFICIENCY · OVER 60 YEARS · BS&B · RELIABILITY

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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Oil & Gas Equipment Div., Dept. 1-BQ10
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STANDARD DOMESTIC
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Those who know demand the best. For gas distribution systems there is no finer equipment than that produced by Sprague. The Sprague 175 Standard Domestic meter is but one of a line of meters with an exceptional reputation for accuracy maintained over long service periods. The design simplicity inherent in all Sprague Gas Meters assures extended service life with a proven record of low upkeep costs.

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